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A

PHARMACEUTICAL GUIDE

TO THE

First and Second Examinations

BY

JOHN BARKER SMITH

SECOND EDITION

REVISED AND ENLARGED

LONDON
J. & A. CHURCHILL, NEW BURLINGTON STREET
1874

151. o. 297.

TO

EDWARD REYNOLDS RAY, M.R.C.S. Eng.

THIS BOOK

IS, WITH SINCERE PLEASURE,

Dedicated

BY THE AUTHOR.

PREFACE.

THE Author's aim has been, to supply in one book that information which has hitherto been procured only from several books, by systematic arrangement to aid the memory and save the time of the student, and, finally, to place in the hands of the Pharmaceutical Student a guide which, when supplemented on his part by thoughtful study, and extended by observation and practical experience, shall procure him complete success.

Materia Medica.—The word "country" comprises both habitat and place of export.

Botany.—In the systematic portion individual names have been treated as adjectives, and capitals omitted.

Synopsis.—A few salts occur in the classes of the first part, which would be excluded by a strict classification according to their chemical constitution; such are the carbonates of magnesia and zinc, and the mercury with chalk.

In the second part of the synopsis the figures mostly represent indefinite quantities, the Author having begun to arrange the formulæ according to the metric system, but as that system has not been enforced, his intentions are not carried out; the student is therefore advised to consider that such figures represent ounces, fluids by measure, solids by weight. In a few not very important cases the grain and minim have been taken as synonymous. Preparations of the Appendix are not given. Temperature is regulated by Fahrenheit's thermometer.

The publishing of a second edition has been delayed in order to make the work as complete as possible; the student is advised not to confound systematic thoroughness either with pretence or cram.

The Author is especially indebted to the following works:—

Attfield—Pharmaceutical Chemistry.
Babington—British Botany.
Bentley—Manual of Botany.
British Pharmacopœia.
Degranges—Arithmétique.
Dorvault—L'Officine.
F.P.B.—Livre du Maître.

NOTES ON PHARMACY.

Pharmacy undergoing important changes:—some arising from internal progress intensified by public demand and the zealous response of advanced pharmacists; others are due to trade causations, notably co-operation; from these and other causes pharmacy is in distress.

Demand for skilled pharmacy limited, much of the distributional work as well performed by other trades; *demand* will increase as the functions of pharmacy become more distinct from those of medicine and trade, patent cure-alls being steadily discountenanced; *distribution* requires immediate official definition of the special functions of pharmacists as retailers, supplemented by an authorized and comprehensive tariff of charges, not necessarily interfering with free trade, but resulting as a qualification to examinations already enforced. To pharmacy are also due, increased interest on the extra capital or educational equivalent invested, and, from the education of its followers, increased facilities for the exercise of the higher branches of professional work; such increase being also of public advantage, and without which all general extra educational movements beyond competency must be vexatious, and their promoters hurtful. Approaching alterations in the examinations suggest whence help should first come, namely, from Government, by the allowance of an invariable amount of spirit for medicinal purposes to each pharmacy duty free; it is monstrous that an annual tincture bill of one hundred pounds should represent, even approximately, seventy pounds taxation: whether this should be followed by numerical restrictions is a further consideration.

Co-operation—caused partly by a negligent credit system, large profits having been obtained from gross receipts for the simple distribution of necessary articles of living; now promoted, sustained, and extended on the part of the public from various motives of honourable economy and selfish greed—has seriously damaged pharmacy as a mixed business; duration of effects depends on alterations occasioned by the recognition of co-operation as a natural life principle, or as an intimation from *thrift* to *waste;* permanent effects hurtful to people in proportion to their uselessness, modified by their cash or credit powers of resistance; aiders and abettors being responsible from their motives only; co-operation has grown to be a sudden application of a natural law which humanity requires should be only gradually assimilated, and which properly belongs to an era provided with efficient but rigorously systematic charities, in which habitual wasters are treated as minors, and sinecures abolished as unjustifiable luxuries. Meanwhile, should pharmacy require the help of co-operation for its well-being, pharmacists ought to be fully prepared to adopt and practise it.

J. B. S.

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PHARMACEUTICAL GUIDE.

(FIRST AND SECOND EXAMINATIONS.)

INTRODUCTION TO LATIN GRAMMAR.

GRAMMAR is the expression of ideas in a language according to certain rules, sanctioned by custom and experience, and in it the rules themselves are comprehended.

The Latin alphabet has no *w*, otherwise it is like the English alphabet.

Latin words, like those of most languages, are divided into ten classes, which the student has already learnt from his English grammar; we shall here divide words into four classes, in order to clearly understand the relationship between them.

Noun.—The name of anything existing is called a noun; to prevent its frequent repetition, the pronoun, or fornoun, is used.

A faculty of the mind compels it to trace the connection between things. The process is called abstraction, and by its exercise nouns are divided into two sorts,—one, common nouns, the other proper nouns. Take, for instance, a piece of iron. It possesses certain characters of hardness, brightness, and opacity which have before come under our notice in other metals; hence it has the common name of metal; but it has other properties peculiar to itself, and from a consideration of which we give it the individual name of iron; hence, metal is a common noun, iron a proper noun, so far as regards the comparison of the two ideas of iron and metal. Again, with nouns are compounded certain qualities; as, a white horse, a bitter herb; but as horse and herb may exist, the one not necessarily white, the other not necessarily bitter, it is only reasonable to suppose that the qualities whiteness and bitterness themselves exist, although not apparent unless compounded or concreted with some noun; thus there is a class of names representing abstract nouns.

Nouns may be affected by considerations of number, gender, and case; when a noun represents only one thing it is in the singular number, when more than one it is in the plural number. Gender in English is decided by sex, in Latin and many other languages it is subject to important modifications of the English rule. Case depends chiefly upon the verb to which should the noun give rise, or, should the verb express something done or merely endured by the noun, the noun is then said to be in its first or nominative case. If the action of the verb fall upon the noun, the noun is said to be in the objective or accusative case. In some instances the action expressed by the verb seems hidden or insufficient for its object, when the insufficiency is made up by certain particles (prepositions), and consequently, these particles will be found, like verbs, to govern cases.

Verb.—This is a word which expresses action or being; several sorts are recognised. A verb is active when it expresses an action produced by the nominative of the sentence, and which passes on to an object. A verb is passive when it declares an action received, endured, or suffered by the nominative of the sentence. When an action does not pass on to an object, the verb expressing it is intransitive or neuter, as *he walks;* or should the action fall upon the actor, that is, make the nominative case also the objective case, the verb is called reflective.

It is evident that actions must pass on to objects, and that states of being must also consist of a number of actions more or less apparent, and therefore the active verb, or as it is called the active voice of the verb, is the chief or highest form of the verb, and the others are but modifications of the active verb; for instance, the passive voice of a verb is really the consequent or result of the active voice; the neuter verbs *I rise*, *I walk*, &c., mean nothing more than I raise myself, I move myself, in a certain manner, in which form they are reflective verbs, and these we have seen are active verbs having a particular object; further, the ideas represented by these various verbs may all be expressed by the active voice of the verb; this will be clearly seen on defining such verbs.

Verbs expressing actions, and time making these past, present, or to come, verbs have therefore three principal tenses or times.

Qualities.—In this division may be placed adjective, article, possessive and demonstrative pronouns, and participles, which are used chiefly to qualify nouns; the adverb which qualifies verbs, and the interjection which qualifies either nouns or verbs, expressed or understood.

Particles.—These are of two kinds: one prepositional, expressing relative position of things or used as adjuncts to verbs; the other conjunctional, used chiefly to join sentences.

ARTICLE.

The demonstrative pronoun *hic*, *hæc*, *hoc* is sometimes called an article, otherwise there are no articles.

NOUNS.

Nouns are subject to number, case, and gender; they mostly vary to express number and case.

NUMBER.—A noun which represents one thing is in the singular number, but if more than one it is in the plural number. Each number is subject to the same cases as the other.

Case.—There are six cases, and five variations of these cases called declensions.

1. *Nominative.*—The noun is in this case when it is the actor, doer, or that of whom or of which something is declared; it will appear in the sentence as answer to the question who or what asked with the verb, as Who is brave? Who commands? Who is envied? Cæsar is brave, he commands, he is envied.
2. *Genitive.*—A noun is generally in this case when it expresses possession, close relationship or connection between things; it corresponds in most instances with the English *of* and *s* with apostrophe. It will be the noun which answers to the question whose? of whom? or of what? which is put in this case.
3. *Dative.*—This case in English is represented by the signs *to* and *for*. In Latin it is often used to express possession, as, *there is to him* instead of *he has;* the dative case is a sort of indirect accusative, or the result of a reflected action from an accusative expressed or understood. It answers to the questions unto whom? to or for what? Some prepositions when compounded govern this case.
4. *Accusative.*—The noun on which the action of the verb falls is in the accusative case; it answers to the question whom? or what? The accusative, dative, and ablative cases follow certain prepositions (or prepositional prefixes).
5. *Vocative.*—The vocative case is used for calling or speaking to, as O mî filî; O my son. So far as declension is concerned, the noun in this case is generally like the nominative.

6. *Ablative.*—The noun is put into this case where in English the words *with*, *from*, *by*, *in*, *compared with*, or *than* occur; it is like the dative in many instances, a modified or reflected accusative.

Although nouns are subject to the same cases, they do not vary in the same manner to express these cases; there are five distinct divisions called declensions, and which are distinguished by different terminations of the genitive case singular; these terminations are *æ*, *i*, *is*, *ūs*, *ei;* nouns of which the genitive case singular is *æ* belong to the first declension, those having *i*, to the second declension, &c.

Note.—Ablative singular vowel endings *a*, *e*, *i*, *o*, *u;* *o* mostly dative or ablative singular, second declension; *m*, when not *uum* or *rum*, accusative case singular of all declensions; (*is*) in dative and ablative cases plural of the first and second declensions, also insertion of (*bu*) between *i* and *s* in the same cases of the third and fourth declensions; ablative and dative cases plural alike: *orum* and *arum* often *ûm*.

1*st Declension.*—Nouns of this declension end in *a*, but certain Greek nouns in *as*, *ēs*, *ē*, belong to it. Genitive case rarely terminates in *i* or *as*.

	N.	G.	D.	Ac.	V.	Ab.
Singular.	**Fossa**	**Fossæ**	**Fossæ**	**Fossam**	**Fossa**	**Fossâ**
Plural.	**Fossæ**	**Fossarum**	**Fossis**	**Fossas**	**Fossæ**	**Fossis**

Thus decline feminine forms of: Passive and future participles, possessive pronouns, ordinals, adjectives of three terminations, and those in superlative degree.

2*nd Declension.*—Nouns of this declension end in *ĕr*, *ŭs*, *ŭm*, those ending in *ĕr*, with the exception of a few, drop the *e* before the *r* in the genitive case singular, and consequently in the other cases of both numbers. Nouns in *us* have vocative *e;* or in *ius*, vocative *i;* those ending in *um* retain that termination in three of the cases, singular number, and have the corresponding cases, plural number, ending in *a*.

A few nouns of this declension terminate in *ēr*, *ĭr*, *ŭr*; and some Greek nouns in *ōs*, *ūs*, *ŏs*, *on*, belong to this declension.

	N.	G.	D.	Ac.	V.	Ab.
Singular.	Ager	Agri	Agro	Agrum	Ager	Agro
Plural.	Agri	Agrorum	Agris	Agros	Agri	Agris; or

	N. Ac. V.	G.	D. & Ab.
Singular.	Bellum	Belli	Bello
Plural.	Bella	Bellorum	Bellis

Thus decline masculine and neuter forms of: Passive and future participles, possessive pronouns, ordinals, adjectives of three terminations, and those in superlative degree.

3*rd Declension.*—Terminational letters *c*, *r*, *a*, *i*, *n*, *e*, *l*, *d*, *s*, *t*, *o*, *y*, *x*; most common, *n*, *o*, *r*, *s*, *x*. Some are Greek, especially those ending in *a*, which letter is always preceded by *m*. Nouns ending in *c*, *a*, *t*, *e*, *l*, *n*, *ar*, *us*, *ur*, will generally be found with nom., acc., and voc. cases alike, plural ending in *a*.

Often increase of syllables in genitive, singular, increment retained in other cases of both numbers. Some of the nouns have their accusative singular in *em*; others in *im* or *in*, and the latter as well as nouns in *e*, *al*, *ar*, make ablative singular *i*, and like nouns ending in *es* and *is*, not increasing, have genitive plural in *ium*.

	N.	G.	D.	Ac.	V.	Ab.
Singular.	Pars	Partis	Parti	Partem	Pars	Parte
Plural.	Partes	Partium	Partibus	Partes	Partes	Partibus

Thus decline: Adjectives of one and two terminations, adjectives in comparative degree, participles in *ns*, also these adjectives—*acer*, *alacer*, *equester*, *celer*, (*is*, *e*), and the pronouns *nemo*, *nostras*, *vestras*, *cujas*.

4*th Declension.*—Nouns of this declension end in *ŭs*, rarely in *ūs*, *o*, *u*; those in *u* have mostly *ūs* in the genitive singular, and other cases of that number like nominative, but in plural number they have genitive, dative, and ablative like nouns in *us*, the other three cases terminating in *a*.

Some make dative and ablative cases plural in *ubus* instead of *ibus;* others (portus, genu, veru) have both terminations indifferently; again, lacus, laurus, quercus, pinus, ficus, cornus, have genitive singular in *i*, or *ûs*.

	N.	G.	D.	Ac.	V.	Ab.
Singular.	**Exercitus**	**Exercitûs**	**Exercitui**	**Exercitum**	**Exercitus**	**Exercitu**
Plural.	**Exercitus**	**Exercituum**	**Exercitibus**	**Exercitus**	**Exercitus**	**Exercitibus**

5th Declension.—Nouns in this declension end in *iēs*, except three, which end in *ēs;* only a few are declined in both numbers and in all cases: some are common to the third declension.

	N.	G.	D.	Ac.	V.	Ab.
Singular.	Dies	Diei	Diei	Diem	Dies	Die
Plural.	Dies	Dierum	Diebus	Dies	Dies	Diebus

GENDER.—In the English language gender is for the most part decided by sex; thus, inanimate and some forms of animate beings, as insects, are spoken of as neuter, whilst other animate beings are either masculine or feminine. The principle of sex has much to do with gender in the Latin language, in which there are also three—masculine, feminine, and neuter; but it will be found that not only names pertaining to males are masculine, but even the names of inanimate things which are as it were the cause of the existence of another,—for instance, names of time divisions, of months, winds, rivers, and mountains are masculine; and so with the feminine gender, which not only includes the names of females, but also those of inanimate things which are in some measure recipient of actions. Frequently the gender of the noun depends not so much upon the idea of any masculine or feminine quality which it represents, as upon its termination or declension.

General Rules of Gender.

Masculine Gender.—Names of males; names derived from the occupation of males; names of winds, rivers, months, and mountains; nouns of the second declension ending in *er*, and generally those in *us*, *ir*, and *os;* nouns of the third declension ending in *or*, *os*, *er*, *es*, and *o* when that letter is not preceded by *b*, *d*, *g*, or *i;* also nouns increasing short; and nouns of the fourth declension, acus, manus, porticus, tribus, are feminine.

Feminine Gender.—Names of females; names derived from the occupation of females; names of trees, herbs, cities, countries, and islands are feminine, explained by saying because *arbor*, *urbs*, *regio*, and *insula* are feminine; nouns of the first declension; nouns of the third declension ending in *as*, *aus*, *is*, *x*, *do*, *go*, *io*, and *s* with a consonant before it; and those of the same declension which are monosyllables, those increasing long and those which do not increase; nouns of the fourth declension in *o;* and nouns of the fifth declension.

Neuter.—Nouns that are indeclinable, or which end in *um* or *u*, are neuter; nouns of the third declension, ending in *c*, *a*, *t*, *e*, *l*, *n*, *ar*, *ur*, and *us:* neuters, whether noun or quality, have the nominative, vocative, and accusative alike, and in the plural these cases end in *a*.

Common.—Judex, artifex, bos, advena, infans, &c.

ADJECTIVES.

Adjectives are subject to declension and comparison; they are declined like nouns of the first, second, and third declensions, and are divided into three classes; to the first class belong those adjectives which have a separate termination for each gender, the masculine ending in *us* and *er*, the neuter in *um*. These are declined like corresponding nouns of the second declension, the feminine ending in *a* is declined according to the first declension of nouns.

The second and third classes consist of adjectives declined like nouns of the third declension; those adjectives of the second class have the termination *is* for the masculine and feminine genders, and *e* for the neuter, whilst those of the third class have the same nominative singular for each gender, otherwise this class is like the second.

Adjectives, then, are of three terminations, as *bonus, bona, bonum;* of two terminations, as *tristis, tristis, triste;* or of one termination, as *sapiens, sapiens, sapiens.*

There are three degrees of comparison: the adjective is in the positive degree when it is in its simplest or first form; in the comparative, when it expresses more or less of a quality; and in the superlative, when it expresses most or least of a quality, or very.

The comparative degree is formed from the first case of the positive degree ending in *i*, by adding thereto the termination *or* for the masculine and feminine genders, and *us* for the neuter; the superlative is formed also from the positive degree by adding to the first case in *i* the terminations *ssimus, ssima, ssimum,* according to the gender required.

The superlative degree of adjectives ending in *er* is formed by adding to the nominative case singular the terminations *rimus, rima, rimum.* Some adjectives ending in *lis* form the superlative degree by the change of *is* into *limus, lima, limum.*

When a vowel comes before *us* in the nominative case the comparison is often made by *magis* and *maxime,* used with the adjective, instead of any change to express degree.

Adjectives of which the positive degree ends in *dicus, ficus, volus,* change *us* into *entior* for comparative, and into *entissimus* for superlative.

Irregular Adjectives.

Positive.	*Comparative.*	*Superlative.*
Bonus	Melior	Optimus
Deter	Deterior	Deterrimus
Dexter	Dexterior	Dextimus
Dives	Ditior	Ditissimus
Externus Exterus	Exterior	Extremus
Inferus	Inferior	Infimus *or* imus
Intus	Interior	Intimus
Juvenis	Junior	———
Magnus	Major	Maximus
Malus	Pejor	Pessimus
Multus	Plus	Plurimus
Nequam	Nequior	Nequissimus
Parvus	Minor	Minimus
Posterus	Posterior	Postremus
———	Prior	Primus
———	Propior	Proximus
Senex	Senior	———
Sinister	Sinisterior	———
———	Ulterior	Ultimus
Superus	Superior	Supremus

Terminations of adjectives of the first class; and of adjectives in the superlative degree.

	Singular.				*Plural.*		
	M.	F.	N.		M.	F.	N.
N.	er, us	a	um	N. & V.	i	æ	a
G.	i	æ	i	G.	orum	arum	orum
D.	o	æ	o	D. & Ab.	is	*all*	*genders*
Ac.	um	am	um	Ac.	os	as	a
V.	er, e	a	um				
Ab.	o	â	o				

Example of adjectives of one and two terminations; also of the comparative degree of adjectives.

	Singular.		*Plural.*	
	M. & F.	N.	M. & F.	N.
N. & V.	Tristis	Triste	Tristes	Tristia
G.	Tristis	Tristis	Tristium	Tristium
D. & Ab.	Tristi	Tristi	Tristibus	Tristibus
Ac.	Tristem	Triste	Tristes	Tristia

Adjectives of one termination differ from those of two terminations in declension only in having a common ending for the nominative case singular, as *x*, *x*, *x*, *ns*, *ns*, *ns;* this form of course is retained by the neuter gender in the accusative and vocative cases.

Adjectives in the comparative degree are declined like *tristis*, except that the terminations will be preceded by *or*, and the *e* of the neuter changed into *us*.

M. F. durior, N. durius, M. F. N. *genitive* durioris.

The ablative case singular of adjectives of the second and third class may generally end in *e* or *i*; but if the neuter end in *e*, as in *triste*, the ablative must always be *i*.

Numerals.—Of these there are four principal sorts: cardinals, as one, two; ordinals, as first, second; distributives, as, one each, two each; and numeral adverbs, as once, twice.

Cardinal numbers, except one, two, three, are, to a hundred, indeclinable.

Ordinals (both numbers) and distributives (plural) are declined like adjectives of three terminations, as *bini*, *binæ*, *bina*.

Unus is declined like an adjective of three terminations, but genitive *unius* dative *uni; so* totus, nullus, solus, ullus, alius, alter, uter.

Duo dative and ablative cases, masculine and neuter *obus*, feminine *abus*.

Tres is declined like *tristes*, but genitive *trium*.

The distributives end in *ni*, and are declinable; the numeral adverbs mostly end in *ies;* tens from thirty to a hundred in the cardinals end in *ginta* and are indeclinable; the hundreds to ten end in *enti* or *genti*, and with the corresponding ordinals are declined like adjectives of three terminations, cardinals in plural number, ordinals both numbers.

Figures.	*Cardinals.*	*Ordinals.*	*Distributives.*	*Adverbs.*
I.	Unus, a, um	primus	singuli	semel
II.	duo, æ, duo	secundus	bini	bis
III.	tres, tres, tria	tertius	terni	ter
IV.	quatuor	quartus	quaterni	quater
V.	quinque	quintus	quini	quinquies
VI.	sex	sextus	seni	senies
VII.	septem	septimus	septeni	septies
VIII.	octo	octavus	octoni	octies
IX.	novem	nonus	noveni	novies
X.	decem	decimus	deni	decies
XI.	undecim	undecimus	undeni	undecies
XII.	duodecim	duodecimus	duodeni	duodecies
XIII.	tredecim	tertius decimus	terni deni	terdecies
XIV.	quatuordecim	quartus decimus	quaterni deni	quatuordecies
XV.	quindecim	quintus decimus	quini deni	quindecies
XVI.	sedecim	sextus decimus	seni deni	sedecies
XVII.	septendecim	septimus decimus	septeni deni	decies et septies
XVIII.	octodecim, or duodeviginti	duodevicesimus	octoni deni	duodevicies
XIX.	undeviginti	undevicesimus	noveni deni	undevicies
XX.	viginti	vicesimus	viceni	vicies
XXI.	unus et viginti	vicesimusprimus	viceni singuli	semel et vicies
XXX.	triginta	tricesimus	triceni	tricies
XL.	quadraginta	quadragesimus	quadrageni	quadragies
L.	quinquaginta	quinquagesimus	quinquageni	quinquagies
LX.	sexaginta	sexagesimus	sexageni	sexagies
LXX.	septuaginta	septuagesimus	septuageni	septuagies
LXXX.	octoginta	octogesimus	octogeni	octogies
XC.	nonaginta	nonagesimus	nonageni	nonagies
C.	centum	centesimus	centeni, etc.	centies, etc.
CC.	ducenti, æ, a	ducentesimus		
CCC.	trecenti, æ, a	trecentesimus		
CCCC.	quadringenti, æ, a	quadringentesimus		
D.	quingenti, æ, a	quingentesimus		
DC.	sexcenti, æ, a	sexcentesimus		
DCC.	septingenti, æ, a	septingentesimus		
DCCC.	octingenti, æ, a	octingentesimus		
DCCCC.	nongenti, æ, a	nongentesimus		
M.	mille	millesimus		
MM.	duo millia	bis millesimus		

PRONOUNS.

Pronouns are, personal, relative, possessive, interrogative, demonstrative, or indeterminate.

Ille, *iste*, and *ipse* declined like *unus*, but in neuter gender *iste* and *ille* make *ud* instead of *um*.

Sui, of himself, herself, itself, and themselves, has no nominative.

Ego, *tu*, sometimes suffixed by *met* (self, selves) and *cum*.

	Singular.				*Plural.*	
N.	Ego	Tu	(Se)	N. & Acc.	nos	vos
G.	mei	tui	sui	G.	nostrûm,	vestrûm
D.	mihi	tibi	sibi		*or* nostri	vestri
Acc. & Ab.	me	te	se	Da. & Ab.	nobis	vobis
V.	—	tu	—	V.	—	vos

Is, *ea*, *id*: he, she, it; and *idem*, *eadem*, *idem*.

	Singular.			*Plural.*		
	M.	F.	N.	M.	F.	N.
N.	is	ea	id	ii	eæ	ea
G.	ejus	*all genders*		eorum	earum	eorum
D.	ei	*all genders*		iis, eis, or îs,	*all genders*	
Ac.	eum	eam	id	eos	eas	ea
Ab.	eo	eâ	eo	iis, eis, or îs,	*all genders*	

Qui, quæ, quod, *who*.

(Suffixes, cumque, dam, vis, libet.)

N.	qui	quæ	quod	qui	quæ	quæ
G.	cujus	*all genders*		quorum	quarum	quorum
D.	cui	*all genders*		quibus	*all genders*	
Ac.	quem	quam	quod	quos	quas	quæ
Ab.	quo	quâ	quo	quibus	*all genders*	

Hic, hæc, hoc, *this*.
(Prefix, ist; suffix, ce.)

V. & N.	hic	hæc	hoc	hi	hæ	hæc
G.	hujus	*all genders*		horum	harum	horum
D.	huic	*all genders*		his	*all genders*	
Ac.	hunc	hanc	hoc	hos	has	hæc
Ab.	hôc	hâc	hôc	his	*all genders*	

Quis, who? is declined like *qui*, except that *quid* is sometimes substituted for *quod*, and *qua* in the neuter plural and feminine singular for *quæ*. Prefixes, ali, ec, si, ne, num; suffixes, piam, nam, quis, que, quam.

VERBS.

Verbs have two voices—active, as, *I command;* passive, as, *I am commanded;* these voices are differently conjugated: the active and passive voices together form conjugations proper, of which there are four. The first is distinguished by *ā*, the second by *ē*, the third by *ĕ*, and the fourth by ī, before *re* of the infinitive mood, active voice. Verbs expressing actions which do not pass on to objects are neuter; but certain verbs called deponents are, under a passive form, active in signification.

As whatever is expressed by the verb is or is not, may be or may not be, so verbs are in corresponding modes or moods—namely, the indicative and potential; moreover, what the verb expresses may depend upon something else either done, or to be done, when the verb is in the subjunctive mood, which is known in English by the sign *if*.

The infinitive mood is in English generally known by the sign *to;* it has no limits, number, or concord with a nominative.

The verb which commands or entreats is in the imperative mood.

Actions or states of being, may be present, past, or future, therefore verbs have three principal tenses or times: again, it may be necessary to mention an action with reference to another, the first action might be going on at the same time that the second occurs or is going on, when the first would be unfinished or imperfect; or if it be completed when the second occurs, it is past perfect or pluperfect; thus there are five tenses.

The noun of which the verb declares may be singular or plural, it may be first, second, or third person; and as a verb agrees with its nominative in number and person, verbs which are in the finite moods generally have three persons and two numbers; there are some having but the third person, and are called impersonal.

The verb *esse*, to be, or *sum*, is thus conjugated:—

Indicative Mood.			*Subjunctive Mood.*		

Present.

Sum	I am		Sim	I	mayest, canst, may or can be
es	thou art		sis	thou	
est	he is		sit	he	
sumus	we	are	simus	we	
estis	you		sitis	you	
sunt	they		sint	they	

Imperfect.

eram	I	was	essem	I	mightest, &c. might, would, &c. be
eras	thou	wast	esses	thou	
erat	he	was	esset	he	
eramus	we	were	essemus	we	
eratis	you		essetis	you	
erant	they		essent	they	

Indicative Mood.			*Subjunctive Mood.*		

Perfect.

fui	I have been		fuerim	I	
fuisti	thou hast been		fueris	thou	mayest,
fuit	he has (hath) been		fuerit	he	
fuimus	we		fuerimus	we	may have
fuistis	you	have been	fueritis	you	been
fuērunt *or* fuēre	they		fuerint	they	

Pluperfect.

fueram	I		fuissem	I	
fueras	thou	hadst	fuisses	thou	mightest,
fuerat	he		fuisset	he	
fueramus	we	had been	fuissemus	we	might, &c.
fueratis	you		fuissetis	you	have been
fuerant	they		fuissent	they	

Future.

ero	I		fuero	I	
eris	thou	shalt or	fueris	thou	shalt or
erit	he	wilt	fuerit	he	wilt,
erimus	we	shall or will	fuerimus	we	shall have
eritis	you	be	fueritis	you	been
erunt	they		fuerint	they	

Infinitive Mood.

Esse, to be ; fuisse, to have been ; futurum esse, *or* fuisse, to be about to be.

Imperative Mood.

Es *or* esto, be thou	Este *or* estote, be ye
esto, let him be	sunto, let them be.

Participle, futurus, about to be.

Possum is conjugated in a similar manner to esse ; by adding *pos* before those tenses and persons of the verb which begin with *s*, *pot* before those in *e*, and *potu* instead of *fu* in the perfect and pluperfect tenses.

Prosum has *d* after pro where sum begins with *e*. There are compounds with *inter*, *ad*, *de*, *ob*, *præ*.

There are only two tenses of the verb forem, I should be.

Imperfect and Perfect.—Forem, fores, foret; foremus foretis, forent.

Infinitive Mood.—Fore, to be, *or* to be about to be.

Participles are words which resemble nouns in declension, adjectives in gender and number, and verbs in tense; thus they may govern, like verbs, and agree, like adjectives. Present participles end in *ans* or *ens;* past participles in *us;* future participles in *rus* or *dus*.

Gerunds.—Parts of verbs used substantively; they have power of governing like the verbs from which they are derived: they are not qualified by adjectives, they end in *di*, *do*, *dum* (of, in, to); they correspond with the English termination *ing*, but are less comprehensive.

Supines—The first supine ends in *um*, and is used after verbs of motion; the second ends in *u*, and is used after certain adjectives: they are generally translated by the infinitive mood in English. Supines are formed from perfect tense of verbs.

Regular verbs are those which have their principal tenses ending as follows:—

	Infinitive.	*Present.*	*Perfect.*	*Past Participle.*
1	āre	o	avi	atus
2	ēre	eo	ui	ĭtus
3	ĕre	o	i	tus
4	īre	io	ivi	ītus

With the exceptions of bĭbi, dĕdi, fĭdi, scĭdi, stĕti, stĭti, tŭli, dissyllable perfects have the first syllable long if the next syllable begins with a consonant.

THE REGULAR CONJUGATIONS.

FIRST CONJUGATION.

	Active.	Passive.
	Gerunds.	
	Aman'dum	
	Aman'di	
	Aman'do	
	Supine.	
	Amā'tum	Amā'tu
	Participles.	
Present.	A'mans	Amā'tus, a, um (past)
Future.	Amatū'rus	Amandus, a, um
	Infinitive.	
Present.	Amā're	Amā'ri
Past.	Amavis'se	Amā'tum esse
Future.	Amatū'rum esse	Amā'tum i'ri

Imperative.

	Active.	Passive.
	Singular.	
2	A'mā Amā'to	Amā're Amā'tor
3	A'met Amā'to	Amē'tur Amā'tor
	Plural.	
2	Amā'te Amatō'te	Amā'mini Amā'minor
3	A'ment Aman'to	Amen'tur Aman'tor

		Indicative.		Subjunctive.	
Present	Sing.	A'mo	A'mor	A'men	A'mer
		A'mas	Amā'ris	A'mes	Amē'ris
		A'mat	Amā'tur	A'met	Amē'tur
	Plural	Amā'mus	Amā'mur	*Amē'mus	*Amē'mur
		Amā'tis	Amā'mini	Amē'tis	Amē'mini
		A'mant	Aman'tur	A'ment	Amen'tur
Imperfect	Sing.	Amā'bam	Amā'bar	Amā'rem	Amā'rer
		Amā'bas	Amabā'ris	Amā'res	Amarē'ris
		Amā'bat	Amabā'tur	Amā'ret	Amarē'tur
	Plural	Amabā'mus	Amabā'mur	Amarē'mus	Amarē'mur
		Amabā'tis	Amabā'mini	Amarē'tis	Amarē'mini
		Amā'bant	Amaban'tur	Amā'rent	Amaren'tur
Past	Sing.	Amā'vi	Amā'tus sum	Amā'verim	Amā'tus sim
		Amavis'ti	Amā'tus es	Amā'veris	Amā'tus sis
		Amā'vit	Amā'tus est	Amā'verit	Amā'tus sit
	Plural	Amā'vimus	Amā'ti sumus	Amavĕ'rimus	Amā'ti simus
		Amā'vis'tis	Amā'ti estis	Amavĕ'ritis	Amā'ti sitis
		Amavē'runt ēre	Amā'ti sunt	Amā'verint	Amā'ti sint
Pluperfect	Sing.	Amā'veram	Amā'tus eram	Amavis'sem	Amā'tus essem
		Amā'veras	Amā'tus eras	Amavis'ses	Amā'tus esses
		Amā'verat	Amā'tus erat	Amavis'set	Amā'tus esset
	Plural	Amaverā'mus	Amā'ti eramus	Amavis'sēmus	Amā'ti essemus
		Amaverā'tis	Amā'ti eratis	Amavis'sētis	Amā'ti essetis
		Amā'verant	Amā'ti erant	Amavis'sent	Amā'ti essent
Future	Sing.	Amā'bo	Amā'bor	Amā'vero	Amā'tus ero
		Amā'bis	Amā'beris	Amā'veris	Amā'tus eris
		Amā'bit	Ama'bitur	Amā'verit	Amā'tus erit
	Plural	Amā'bimus	Amā'bimur	Amaveri'mus	Amā'ti erimus
		Amā'bitis	Amabĭ'mini	Amaveri'tis	Amā'ti eritis
		Amā'bunt	Amabun'tur	Amā'verint	Amā'ti erunt

* The first person plural number subjunctive mood is used for the first person plural number imperative mood.

THE REGULAR CONJUGATIONS—*continued.*

SECOND CONJUGATION.

	ACTIVE.	PASSIVE.
	Gerunds.	
	Monen'dum	
	Monen'di	
	Monen'do	
	Supine.	
	Mŏ'nitum	Mŏ'nitu
	Participles.	
Present	Mŏ'nens	Mŏ'nitus, a, um (past)
Future	Monitū'rus	Monen'dus, a, um
	Infinitive.	
Present.	Mŏnē're	Mŏne'ri
Past.	Monuis'se	Mŏ'nitum esse
Future.	Monitū'rum esse	Mŏ'nitum irī

	ACTIVE.	PASSIVE.
	Imperative.	
	Singular.	
2	Mo'nē Monē'to	Monē're Monē'tor
3	Mŏ'neat Monē'to	Moneā'tur Monē'tor
	Plural.	
2	Monē'te Monetō te	Monē'mini Monē'minor
3	Mo'neant Monen'to	Monean'tur Monen'tor

		INDICATIVE.		SUBJUNCTIVE.	
Present	Sing.	Mŏ'neo	Mŏ'neor	Mŏ'neam	Mŏ'near
		Mŏ'nes	Monē'ris	Mŏ'neas	Moneā'ris
		Mŏ'net	Monē'tur	Mŏ'neat	Moneā'tur
	Plural	Monē'mus	Monē'mur	*Moneā'mus	*Moneā'mur
		Monē'tis	Monē'mini	Moneā'tis	Moneā'mini
		Mŏ'nent	Monen'tur	Mŏ'neant	Monean'tur
Imperfect	Sing.	Monē'bam	Monē'bar	Monē'rem	Monē'rer
		Monē'bas	Monebā'ris	Monē'res	Monerē'ris
		Monē'bat	Monebā'tur	Monē'ret	Monerē'tur
	Plural	Monebā'mus	Monebā'mur	Monerē'mus	Monerē'mur
		Monebā'tis	Monebā'mini	Monerē'tis	Monerē'mini
		Monē'bant	Moneban'tur	Monē'rent	Moneren'tur
Past	Sing.	Mŏ'nui	Mŏ'nitus sum	Monŭ'erim	Mŏ'nitus sim
		Monuis'ti	Mŏ'nitus es	Monŭ'eris	Mŏ'nitus sis
		Mon'uit	Mŏ'nitus est	Monŭ'erit	Mŏ'nitus sit
	Plural	Monŭ'imus	Mŏ'niti sumus	Monŭe'rimus	Mŏ'niti simus
		Monuis'tis	Mŏ'niti estis	Monŭe'ritis	Mŏ'niti sitis
		Monuē'runt, ēre	Mŏ'niti sunt	Monŭ'erint	Mŏ'niti sint
Pluperfect	Sing.	Monŭ'eram	Mŏ'nitus eram	Monuis'sem	Mŏ'nitus essem
		Monŭ'eras	Mŏ'nitus eras	Monuis'ses	Mŏ'nitus esses
		Monŭ'erat	Mŏ'nitus erat	Monuis'set	Mŏ'nitus esset
	Plural	Monuerā'mus	Mŏ'niti eramus	Monuissē'mus	Mŏ'niti essemus
		Monuerā'tis	Mŏ'niti eratis	Monuissē'tis	Mŏ'niti essetis
		Monŭ'erant	Mŏ'niti erant	Monuis'sent	Mŏ'niti essent
Future	Sing.	Monē'bo	Monē'bor	Monŭ'ero	Mŏ'nitus ero
		Monē'bis	Monē'beris	Monŭ'eris	Mŏ'nitus eris
		Monē'bit	Monē'bitur	Monŭ'erit	Mŏ'nitus erit
	Plural	Monē'bimus	Monē'bimur	Monuerī'mus	Mŏ'niti erimus
		Monē'bitis	Monebī'mini	Monuerī'tis	Mŏ'niti eritis
		Monē'bunt	Monebun'tur	Monŭ'erint	Mŏ'niti erunt

• The first person plural number subjunctive mood is used for the first person plural number imperative mood.

THE REGULAR CONJUGATIONS—*continued.*

THIRD CONJUGATION.

	Active.	Passive.
	Gerunds.	
	Regen'dum	
	Regen'di	
	Regen'do	
	Supine.	
	Rec'tum	Rec'tu
	Participles.	
Present	Rĕ'gens	Rec'tus, a, um (past)
Future	Rectū'rus	Regen'dus, a, um
	Infinitive.	
Present	Rĕ'gĕre	Rĕ'gi
Past	Rexis'se	Rec'tum esse
Future	Rectu'rum esse	Rec'tum i'ri

	Active.	Passive.
	Imperative.	
	Singular.	
2	Rĕ'gĕ	Rĕ'gere
	Rĕ'gito	Re'gitor
3	Rĕ'gat	Regā'tur
	Rĕ'gito	Rĕ'gitor
	Plural.	
2	Rĕ'gite	Regī'mini
	Regitō'te	Regi'minor
3	Rĕ'gant	Regan'tur
	Regun'to	Regun'tor

		Indicative.		Subjunctive.	
Present	Sing.	Rĕ'go	Rĕ'gor	Rĕ'gam	Rĕ'gar
		Rĕ'gis	Rĕ'geris	Rĕ'gas	Regā'ris
		Rĕ'git	Rĕ'gitur	Rĕ'gat	Regā'tur
	Plural	Rĕ'gimus	Rĕ'gimur	*Regā'mus	*Regā'mur
		Rĕ'gitis	Regī'mini	Regā'tis	Regā'mini
		Rĕ'gunt	Regun'tur	Rĕ'gant	Regan'tur
Imperfect	Sing.	Regē'bam	Regē'bar	Rĕ'gerem	Rĕ'gerer
		Regē'bas	Regebā'ris	Rĕ'geres	Regerē'ris
		Regē'bat	Regebā'tur	Rĕ'geret	Regerē'tur
	Plural	Regebā'mus	Regebā'mur	Regerē'mus	Regerē'mur
		Regebā'tis	Regebā'mini	Regerē'tis	Regerē'mini
		Regē'bant	Regeban'tur	Rĕ'gerent	Regeren'tur
Past	Sing.	Rex'i	Rec'tus sum	Rex'erim	Rec'tus sim
		Rexis'ti	Rec'tus es	Rex'eris	Rec'tus sis
		Rex'it	Rec'tus est	Rex'erit	Rec'tus sit
	Plural	Rex'imus	Rec'ti sumus	Rexe'rimus	Rec'ti simus
		Rexis'tis	Rec'ti estis	Rexe'ritis	Rec'ti sitis
		Rexē'runt, ēre	Rec'ti sunt	Rexe'rint	Rec'ti sint
Pluperfect	Sing.	Rex'eram	Rec'tus eram	Rexis'sem	Rec'tus essem
		Rex'eras	Rec'tus eras	Rexis'ses	Rec'tus esses
		Rex'erat	Rec'tus erat	Rexis'set	Rec'tus esset
	Plural	Rexerā'mus	Rec'ti eramus	Rexisse'mus	Rec'tus essemus
		Rexerā'tis	Rec'ti eratis	Rexisse'tis	Rec'ti essetis
		Rex'erant	Rec'ti erant	Rexis'sent	Rec'ti essent
Future	Sing.	Rĕ'gam	Rĕ'gar	Rex'ero	Rec'tus ero
		Rĕ'ges	Rĕgē'ris	Rex'eris	Rec'tus eris
		Rĕ'get	Regē'tur	Rex'erit	Rec'tus erit
	Plural	Regē'mus	Regē'mur	Rexerī'mus	Rec'ti erimus
		Regē'tis	Regē'mini	Rexerī'tis	Rec'ti eritis
		Rĕ'gent	Regen'tur	Rex'erint	Rec'ti erunt

* The first person plural number subjunctive mood is used for the first person plural number imperative mood.

THE REGULAR CONJUGATIONS—*continued.*

FOURTH CONJUGATION.

	ACTIVE.	PASSIVE.
	Gerunds.	
	Audien'dum Audien'di Audien'do	
	Supine.	
	Audi'tum	Audi'tu
	Participles.	
Present	Au'diens	Audi'tus, a, um (past)
Future	Auditu'rus	Audien'dus, a, um
	Infinitive.	
Present	Audi're	Audi'ri
Past	Audivis'se	Audi'tum esse
Future	Auditū'rum esse	Audi'tum iri

Imperative.

	ACTIVE.	PASSIVE.
	Singular.	
2	Au'dī Audī'to	Audi're Audī'tor
3	Au'diat Audi'to	Audia'tur Audī'tor
	Plural.	
2	Audi'te Auditō'te	Audī'mini Audi'minor
3	Au'diant Audiun'to	Audian'tur Audiun'tor

		INDICATIVE.		SUBJUNCTIVE.	
Present	Sing.	Au'dio	Au'dior	Au'diam	Au'diar
		Au'dis	Audī'ris	Au'dias	Audiă'ris
		Au'dit	Audī'tur	Au'diat	Audiă'tur
	Plural	Audī'mus	Audī'mur	*Audiă'mus	*Audiă'mur
		Audi'tis	Audī'mini	Audiă'tis	Audiă'mini
		Au'diunt	Audiun'tur	Au'diant	Audian'tur
Imperfect	Sing.	Audiē'bam	Audiē'bar	Audī'rem	Audī'rer
		Audiē'bas	Audiēba'ris	Audī'res	Audirē'ris
		Audiē'bat	Audiēbā'tur	Audi'ret	Audirē'tur
	Plural	Audiebā'mus	Audiēbā'mur	Audirē'mus	Audirē'mur
		Audiebā'tis	Audiēbā'mini	Audirē'tis	Audirē'mini
		Audiē'bant	Audiēban'tur	Audī'rent	Audiren'tur
Past	Sing.	Audī'vi	Audī'tus sum	Audī'verim	Audī'tus sim
		Audivis'ti	Audī'tus es	Audī'veris	Audī'tus sis
		Audī'vit	Audī'tus est	Audī'verit	Audī'tus sit
	Plural	Audī'vimus	Audī'ti sumus	Audivĕ'rimus	Audī'ti simus
		Audivis'tis	Audīti estis	Audivĕ'ritis	Audi'ti sitis
		Audivē'runt, ēre	Audī'ti sunt	Audī'verint	Audī'ti sint
Pluperfect	Sing.	Audī'veram	Audī'tus eram	Audivis'sem	Andi'tus essem
		Audī'veras	Audī'tus eras	Audivis'ses	Audī'tus esses
		Audī'verat	Audī'tus erat	Audivis'set	Audī'tus esset
	Plural	Audiverā'mus	Audī'ti eramus	Audivissē'mus	Audī'ti essemus
		Audiverā'tis	Audī'ti eratis	Audivissē'tis	Audī'ti essetis
		Audī'verant	Audī'ti erant	Audivis'sent	Audī'ti essent
Future	Sing.	Au'diam	Au'diar	Audī'vero	Audī'tus ero
		Au'dies	Audiē'ris	Audī'veris	Audī'tus eris
		Au'diet	Audiē'tur	Audī'verit	Audī'tus erit
	Plural	Audiē'mus	Audiē'mur	Audiverī'mus	Audī'ti erimus
		Audiē'tis	Audiē'mini	Audiverī'tis	Audī'ti eritis
		Au'dient	Audiēn'tur	Audī'verint	Audī'ti erunt

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* The first person plural number subjunctive mood is used for the first person plural number imperative mood.

Deviations in the four conjugations. (Examples.)

1	Crepare	crepo	crepui	crepitus
„	Plicare	plico	plicui *and* avi	plicatus (plicitus)
„	Dare	do	dedi	datus
2	Delēre	deleo	delēvi	delētus
„	Cavēre	caveo	cavi	cautus
„	Spondēre	spondeo	spospondi	sponsus
„	Jubēre	jubeo	jussi	jussus
„	Mulgēre	mulgeo	mulsi	mulctus
3	Ducĕre	duco	duxi	ductus
„	Gerĕre	gero	gessi	gestus
„	Mittĕre	mitto	misi	missus
„	Rapĕre	rapio	rapui	raptus
„	Noscĕre	nosco	novi	notus
„	Lacessĕre	lacesso	lacessivi	lacessitus
4	Sancīre	sancio	sanxi	sanctus
„	Salīre	salio	salui	saltus
„	Haurīre	haurio	hausi	haustus

The letters *d* and *t* are frequently omitted before *s* in the formation of the perfect and participle.

Verbs, including the verb *to be* and deponents, are sometimes made up of a preposition followed by a verb; these are called compound verbs. The preposition is also frequently altered in form thus, *a* is followed by *b*, *bs*, *u*; the *d* of *ad*, is changed into *c*, *f*, *g*, *l*, *n*, *p*, *r*, *s*, *t*; the *um* of *cum* in like manner is often *o*, *og*, *ol*, *om*, *on*, *or*, and the *b* of *ob*, *c*, *f*, *g*, *p*, *s*; *pro* is found *prod*, *pol*, *por*; the *n* of *in* is often changed into *l*, *m*, *r*; and *b* of *sub* into *e*, *f*, *g*, *l*, *m*, *p*, *r*.

Deponent verbs belong to each of the conjugations, and may be in sense neuter, passive, or active. When active they have participles, gerunds, and supines, like those of *amo*, *moneo*, &c. Some are called mixed, as *gaudeo*, *gaudebam*, *gavisus sum*. Examples:—

	Infinitive.	*Present.*	*Perfect.*
1	Conari	conor	conatus sum
2	Liceri	liceor	licitus sum
3	Queri	queror	questus sum
4	Potiri	potior	potitus sum

Irregular Verbs.

Velle, p. voluisse	volo	volui	volens, pres. partic.
Nolle, p. noluisse	nolo	nolui	nolens ,, ,,
Malle, p. maluisse	malo	malui	malens ,, ,,
Posse	possum	potui	
Esse	sum	fui	
Ire	eo	ivi	
Ferre	fero	tuli	
Fieri p. factum esse f. factum iri	fio	factus sum	

Like *volo* are conjugated *malo* and *nolo*, but *nol* of *nolo* is changed into *non* before *vis*, *vult*, and *vultis*, moreover the latter has an imperative mood; *mal* of *malo* is changed into *ma* before *vis*, *vult*, and *vultis*, but has like *volo* no imperative mood.

Indicative.

	1	2	3	1	2	3
Pres.	Volo	vis	vult	volumus	vultis	volunt
Imp.	Volebam	volebas	volebat	volebamus	volebatis	volebant
Per.	Volui	voluisti	voluit	voluimus	voluistis	voluerunt *or* voluere
Plup.	Volueram	volueras	voluerat	volueramus	volueratis	voluerant
Fut.	Volam	voles	volet	volemus	voletis	volent

Subjunctive.

Pres.	Velim	velis	velit	velimus	velitis	velint
Imp. {noll. mall.}	Vellem	velles	vellet	vellemus	velletis	vellent
Per.	Voluerim	volueris	voluerit	voluerimus	volueritis	voluerint
Plup.	Voluissem	voluisses	voluisset	voluissemus	voluissetis	voluissent
Fut.	Voluero	volueris	voluerit	voluerimus	volueritis	voluerint

Imperative of Nolo.

noli *or* nolito	nolite *or* nolitote

Indicative.

	1	2	3	1	2	3
Pre.	Eo	is	it	imus	itis	eunt
Imp.	Ibam	ibas	ibat	ibamus	ibatis	ibant
Per.	Ivi	ivisti	ivit	ivimus	ivistis	iverunt *or* ivere
Plup.	Iveram	iveras	iverat	iveramus	iveratis	iverant
Fut.	Ibo	ibis	ibit	ibimus	ibitis	ibunt

Subjunctive.

Pre.	Eam	eas	eat	eamus	eatis	eant
Imp.	Irem	ires	iret	iremus	iretis	irent
Per.	Iverim	iveris	iverit	iverimus	iveritis	iverint
Plup.	Ivissem	ivisses	ivisset	ivissemus	ivissetis	ivissent
Fut.	Ivero	iveris	iverit	iverimus	iveritis	iverint

Imperative.

		i ito	ito		ite itote	eunto

Participle P. iens *Future,* iturus
Gerund. eundum di do
Supine itum itu

Indicative.

Pres.	Fio	fis	fit	fimus	fitis	fiunt
Imp.	Fiebam	fiebas	fiebat	fiebamus	fiebatis	fiebant
Fut.	Fiam	fies	fiet	fiemus	fietis	fient

Subjunctive.

Pre.	Fiam	fias	fiat	fiamus	fiatis	fiant
Imp.	Fierem	fieres	fieret	fieremus	fieretis	fierent

Imperative.

		fi fito	fito		fite fitote	fiunto

Participle P. factus, *Future,* faciendus
Supine. factu

The perfect and pluperfect tenses, indicative mood, and these tenses and the future subjunctive mood, are conjugated like passive verbs; thus *factus sum* or *fui*, *factus eram* or *fueram*, *factus sim* or *fuerim*, *factus essem* or *fuissem*, *factus fuero*.

Fero.

ACTIVE.	PASSIVE.
Gerund.	
Ferendum	
Ferendi	
Ferendo	
Supine.	
Latum	Latu

Imperative.
Singular.

	ACTIVE.	PASSIVE.
2.	Fer *vel* Ferto	Ferre *vel* Fertor
3.	Ferat *vel* Ferto	Feratur *vel* Fertor

Participle.

Ferens	Latus, a, um
Laturus, a, um	Ferendus, a, um

Infinitive.

Ferre	Ferri
Tulisse	Latum esse
Laturum esse	Latum iri

Plural.

1.	Feramus	Feramur
2.	Ferte *vel* Fertote	Ferimini *vel* Feriminor
3.	Ferant *vel* Ferunto	Ferantur *vel* Feruntur

	Indicative.		*Subjunctive.*	
Pre.	Fero	Feror	Feram	Ferar
	Fers	Ferris, ferre	Feras	Feraris
	Fert	Fertur	Ferat	Feratur
	Ferimus	Ferimur	Feramus	Feramur
	Fertis	Ferimini	Feratis	Feramini
	Ferunt	Feruntur	Ferant	Ferantur
Imp.	Ferebam, as	Ferebar, aris	Ferrem	Ferrer
Per.	Tuli, isti	Latus sum	Tulerim	Latus sim
Plup.	Tuleram, as	Latus eram	Tulissem	Latus essem
Fut.	Feram, es	Ferar eris	Tulero	Latus ero

Compounds of fero with prepositions:—Affero, antefero, aufero, circumfero, confero, defero, differo, effero, infero, offero, perfero, postfero, præfero, profero, refero, suffero, transfero.

ADVERBS—*indeclinable.*

Adverbs in *ter*, *e*, and mostly those in *o*, admit of comparison when derived from adjectives or participles; the comparative ends in *ius* and the superlative in *issime :* but multum, plus, plurimum; magnopere, magis, maxime.

Adverbs of place are fivefold, accordingly as they answer, 1. Ubi, where? 2. Quo, whither? 3. Quorsum, whitherward? 4. Unde, whence? 5. Qua, which way? These adverbs are frequently compounded with the above words.

Adverbs of time are threefold: 1. Nunc, 2. Diu, 3. Rursus; there are also adverbs of order, quality, and manner.

PREPOSITIONS—*indeclinable.*

1. Governing the accusative case:

Ad, apud, ante, adversus, adversum, contra, cis, citra, circa, circum, erga, extra, inter, intra, infra, juxta, ob, propter, per, præter, penes, post, pone, secus, secundum, supra, trans, ultra.

2. Governing the ablative case:

A, ab, abs, absque, cum, clam, coram, de, e, ex, pro, præ, palam, sine, tenus.

3. Governing sometimes the accusative case, sometimes the ablative:

In, sub, super, subter, clam.

INTERJECTIONS—*indeclinable.*

Interjections sometimes govern cases; as, Ecce me, ecce homo, hei mihi.

CONJUNCTIONS—*indeclinable.*

Que, *and*, is an enclitic, and is joined to the end of the second of two words: Nocte maneque. Et, *and*, joining several nouns, is repeated after each noun, but it may be entirely omitted. Sentences do not begin with enim, autem, vero, quidem, quoque.

GENERAL RULES OF LATIN SYNTAX.

Syntax is divided into agreement and dependence, otherwise, concord and government. There are three concords, which may be thus expressed: verbs agree with their nominative in number and person; adjectives, adjective pronouns, and participles agree with the nouns they qualify in gender, number, and case; the relative agrees with its antecedent in gender, number, and person, but when it connects by means of the verb *to be*, or a verb of naming, two substantives of different genders, it agrees with the second of the two substantives. Certain antecedents require particular relatives; thus talis, tantus, tot, require qualis, quantus, quot.

The nominative may be a verb in the infinitive mood, an adjective, the noun being understood, or a pronoun, which is not expressed unless for distinction. The first person is more worthy than the second, the latter than the third; the masculine gender is more worthy than the feminine gender, the feminine more worthy than the neuter; therefore when two nominatives singular come together, the plural verb which agrees with them is that of the most worthy person, and the adjective likewise, when it qualifies several singular nouns will be in the plural number, and agree with the most worthy person, but if the nouns are names of inanimate things the adjective may be in the neuter gender.

CASES.

Nominative.—The actor, doer, or person or thing of which something is declared, are put in this case; it also follows verbs of existence, as *to be*, and passive verbs of being called or chosen, and adverbs of showing.

Genitive.—When two nouns of different signification come together, the latter, or one upon which the other depends, is put in the genitive case; but when they signify the same thing, they must be put in the same case: partitives, as *each*, *some*, &c., verbal adjectives in *ax*, and those denoting desire, knowledge, fear, recollection and participation, with their opposites, affections of the mind, fulness, emptiness, and valuing; verbs of esteeming, or of reward, *æstimo*, *facio*, *sum*, *habeo*, *puto*, &c., comparatives and superlatives, and the charge of verbs of acquitting, condemning, and accusing; for the most part require or govern this case.

Dative.—Adjectives which signify advantage, profit, likeness, fitness, duty, pleasing, submission, and their opposites; the verb *sum* in place of *habeo*; the compounds of *sum*, except *possum*; verbs compounded with *ad*, *in*, *inter*, *con*, *præ*, *sub*, and many with *pro*, *ab*, *ante*, *re*, *super*, *de*, or used with the adverbs *bene*, *satis*, and *male*, and those expressing the sense of the prepositions *to* and *for*, as verbs of trusting, telling, commanding, going, and threatening; impersonal verbs; the person who gains, &c.; for the most part govern or require this case.

Accusative.—Transitive verbs, whether active or deponent, govern an accusative case; it is also used before an infinitive mood after such phrases as, *It is certain*, *manifest*, &c., and after verbs of knowing, wishing, feeling, hoping, promising, believing, and thinking; the noun which expresses extent, duration of time, or whither, is for the most part put in this case; verbs of asking, clothing, teaching, and concealing, often govern a double accusative.

Ablative.—Nouns expressing cause, manner, instrument, and price at which a thing is valued; names of towns and small islands when they express whence; nouns which express where, which are not the names of small islands or towns, and are not of the first and second declension singular; nouns following verbs of abounding, filling, loading, wanting, and depriving of, also *fruor*, *fungor*, *utor*, *dignor*, *glorior*, and *potior*, *quam* with the comparative degree, and certain prepositions; are for the most part put in this case.

SUBJUNCTIVE MOOD.

This mood is often used for the English indicative and infinitive; the student may expect to find verbs in this mood when they are preceded by *ut*, that, *ne*, lest, *quominus*, *forsitan*, *quin*, *quasi*, *tanquam*, *dummodo*, *antequam*, *interest*, *refert*, general negation followed by *qui*, or when the verb declares the sentiments of the third person.

EXAMPLES OF GENDER AND DECLENSION.

(Illustrating Exceptions.)

Ex. I.—Adria vagus, aloe amara, aloës drachma, aloen amaram, cometa sinister, planeta rutilus, planetes corusca, filiabus duabus, deabus divinis, animabus, mulabus et asinabus et equabus haec apta sunt, libertabus hoc prodest non servabus, dominabus sociabusque, ignoscere famulabus.

Ex. II.—Alvus soluta, abyssus profunda, arctus splendida, byssus colorata, tuâ colo (*vel* u), omnis diphthongus longa est, domus casta, dialectus molesta, diameter certa, eremus arenosa, exodus tumultuosa, humus graminea, methodus celeris, nardus siccata, papyrus alba, pelagus severum, periodus nota, pharus conspicua, specus fecundus, specus horrendum, specus ultima, sexus noster, sexus nostrum, vannus mystica, virus noxium, vulgus profanus, vulgus profanum.

Ex. III.—Chaos antiquum, æquor illud, hoc ăcer cujus cortex ācer et suberosus est, suber leve, siler molle, cicer sylvestre, siser erraticum simile sativo est, papaver album, tuber turgidum, ver madidum, verber triste, verbera pendent, spinther æreum, æs grave, æra singula, utrum vas vadis an vas vasis, meus vas, meum vas, marmor striatum, ador contritum, piper album vel piper decorticatum, cadaver pallidum, os firmum, os roseum, ossibus, oribus, melos dulce, epos forte, cos aspera, dos ampla, arbor umbrosa, compedes ponderosæ, merces peregrinæ, seges

matura, merges sola, inter duas mergites, teges juncea, requies (ei etis) suavis, quies desidiosa.

Ex. IV.—Ordo primus, pulvis compositus, panis fermentatus, axis erectus, codex durus, codex medicamentarius, cortex rugosus, margo gramineus, margo folii dissecta est, fascis foliosus, hic vertex, vectis ferreus, sanguis concretus, hydrops cysticus, funis stupeus, rudens tortus, thorax pictus, pollex incussus, unguis incurvus, dens attritus, pons ligneus, cassis cristata, casses occulti, piscis squammosus, grex opimus, elephas robustus, ensis destrictus, acinaces acutus, ligo obtusus, postis rigidus, cardo ferratus, vermis exiguus, anguis sinuosus.

Ex. V.—Sol fervidus, sal marinus, sal marinum, lien vel lienis affectus, splen plenus, fur nocturnus, furfur fuscus, pecten eburneus, turtur querulus, vultur montanus, lepus celer, mus parvus, grus aeria, grus aerius, sus setosus, sus ignava, cujum pecus (oris), incus rigida, hæc pecus (ŭdis), and other feminine exceptions which have genitive ūdis, as palus; or genitive ūtis as senectus, juventus, salus, servitus, virtus.

THE LATIN OF PRESCRIPTIONS.

A prescription consists of two sorts of directions: one to the compounder only; the other to the compounder for the administrator of the medicine. Directions for mixing and preparing are not given in an ordinary prescription, it being as much the duty of the compounder as of the prescriber to know the best method of proceeding (*a*).

The directions for the compounder for the patient or administrator of the medicine, will relate to remedies either for internal or external use, and will be comprised in divisions (*b*) and (*c*).

The ingredients ordered in prescriptions are mostly those mentioned in the Pharmacopœia: the terms will be considered under the following heads:—1. Treatment, taking, using. 2. Quantity. 3. Instrument, means, or manner. 4. Part or object. 5. Time mentioned, or depending upon result.

1.

(*a*) The verbs in this division are generally used in the imperative mood; the final vowel sufficiently denotes the conjugation to which they belong; thou, is to be understood with each verb.

Abluĕ; wash. Adhibē; apply. Adjicĕ; add. Admiscē; mingle. Affundĕ; pour upon. Colā; strain. Consumĕ; evaporate. Contegĕ; cover. Contundĕ; bruise. Coquĕ; boil. Decoquĕ; boil down. Effundĕ; pour away. Exponĕ; expose. Exprimĕ; express. Exsiccā; dry. Immittĕ; intermix. Infundĕ; pour in. Lavā; wash. Liquā; melt, dissolve. Macerā; infuse, macerate. Miscē; mix. Movē; stir. Recipĕ; take. Separā; separate. Seponĕ; set aside. Servā; preserve, keep. Sublimā; sublime. Superinfundĕ; pour upon. Terĕ; rub. Transmittĕ; pass through, transmit. Urĕ; burn.

Destillet; let it distil. Pergat: let it continue. Vaporet; let it evaporate. Stet; let it stand.

(*b*) Bibo, ĕre bibi, bibitum; to drink. Capio, ĕre, cepi, captum; to take. Do, dăre, dedi, datum; to give. Gargarizo, āre; to gargle. Manduco, āre; to chew. Repeto, ĕre, ivi, itum; to repeat. Sumo, ĕre, sumpsi, sumptum; to take.

(*c*) Admoveo, ēre, vi, motum; and Applico, āre, ui, atum; to apply. Colluo, ĕre, ui, utum; to wash. Detineo, ēre, ui, tentum; to detain. Foveo, ēre, fovi, fotum; to foment, to nourish. Frico, āre, ui, atum; to rub; also compounded with ad (af), in, and per. Impono, ĕre, posui, positum; to apply. Inflo, āre; to inflate, puff up, &c. Inspergo, ĕre, si, sum; to sprinkle upon. Instillo, āre; to drop in, to instil. Inungo, ĕre, xi, ctum; and Lino, ĕre, livi, litum, with its compounds, in (il), de, super, and ob; to anoint, smear, &c. Sufflo, āre; to blow or puff up. Tango, ĕre, tetigi, tactum; to touch. Utor, uti, usus; to use (deponent).

2.

(*a*) Ana; of each ingredient. Congius, ii; gallon. Drachma, æ; drachm. Granum, i; grain. Gutta, æ; drop. Libra, æ; pound. Mensura, æ; measure. Minimum, i; minim. Octarius, ii; pint. Pondus, ĕris; weight. Quantum, i; quantity. Semissis, is; half. Uncia, æ; ounce.

(*b*) Cochleare, is; C. amplum; C. magnum; a table-spoonful. C. medium or modicum; a dessert-spoonful. C. parvum or minimum; a tea-spoonful. Cyathus, i; a cup. Dimidius, a, um; half. Dosis, is, or ratio, onis; a dose. Pars, tis; a part. Poculum, i; a cup. Quantum, used with placet, lubet, or sufficiat, signifying a sufficient quantity or (ad libitum) at pleasure.

(*c*) Magnitudo, dinis; size. Paululus, a, um, or Pauxillus, a, um; a little, and Tantulus, a, um; a very little; sometimes used as nouns and adverbs.

3.

(*a*) Alembicum, i; an alembic. Aqua calida; hot water. A. fervens, Aqua bulliens; boiling water. A. frigida; cold water. Balneum, i; a bath. B. aquosum; a water-bath. B. arenæ; a sand-bath. Charta bibula; blotting paper. Cribrum, i; a sieve. Crucibulum, i; a crucible. Forma, æ; a form. Ignis lentus; a slow fire. Linteum, i; lint, or linen cloth. Mortarium, ii; a mortar. Pannus, i; cloth. Receptaculum, i; a receiver. Retorta, æ; a retort. Thermometrum, i; a thermometer. Vas fictile; an earthen vessel. Vitreus, a, um; glass.

(*b*) Agitatus, or concussus (a, um); shaken. Cerevisia, æ; beer. Crassus, a, um; thick. Dictus, a, um; said. Durans, tis; during. Effervescentia, æ; effervescence. Gelatina, æ; jelly. Gratus, a, um; agreeable. Guttatim, by drops. Infusum carnis bubulæ; beef tea. I. coffeæ; coffee. I. theæ; tea. Jus, juris; broth, soup. Lac, lactis; milk. Mel, mellis; honey. Mica panis; crumb of bread. Mos, moris; custom, manner. Ovi vitellus; yolk of egg. Pulmentum, i; gruel. Saccharum, i; sugar. Serum lactis; whey. Solitus, a, um; usual. Vehiculum, i; a vehicle. Vinum, i; wine.

(*c*) Aluta, æ; leather. Imbutus, a, um; soaked, wetted. Lanula, æ; flannel. Ope; by means, followed by a genitive case, as, ope çalami, by means of a quill. Syphon, is, Syrinx, ingis; a syphon, a syringe.

4.

(*a*) Fiat; that it may be made, &c. Fiant; that they may be made, &c.

(*b* & *c*) Alvum, liquare, solvĕre, or Sedes promovēre; to act on the bowels. Dolorem tollĕre or lenire; to allay pain. Evocāre, excitāre, inducĕre, perducĕre; to procure, promote, excite, lead to, &c. Humoris detractio; a discharge of fluid. Nutrire, to dress, as, nutrire ulcus. Somnum movēre; to produce sleep. Sudatio, onis; perspiration. Supprimĕre; to suppress. Urina, æ; urine. Vesicāre; to blister. Vomitus, ûs; vomiting.

(*b*) **Dens, tis; a tooth. Fauces, ium; the throat. Gingivæ, arum; the gums. Naris, is; the nostril, pl. nares. Os, oris; the mouth—not to be confounded in meaning with os, ossis; a bone.**

(*c*) Auris, is; ear. Brachium, ii; upper arm. Bucca, æ; cheek. Calx, calcis; heel. Caput, itis; head. Carpus, i; wrist. Cervix, icis; back part of neck. Collum, i; neck. Coxa, æ; hip. Cubitus, i, forearm. Digitus, i; finger. Digiti pedis; toes. Dorsum, i; back. Femur, femoris; thigh. Guttur, uris; throat or forepart of neck. Humerus, i; shoulder. Inguen, inis; groin. Labium, ii; lip. Latus, lateris; side. Lumbus, i; loin. Metacarpium, ii; back of the hand. Mons pedis; instep. Nucha capitis; nape of the neck. Palma, æ; palm of the hand. Palpebra, æ; eyelid. Pars affecta; the affected part. Patella, æ; kneepan. Planta pedis; sole of the foot. Pollex, icis; thumb. Scapula, æ; back of shoulder. Sura, æ; calf of the leg. Sternum, i; breast bone. Tempora; temples (Tempus; time).

5.

(*a*) Ad (with accusative) ad idoneam crassitudinem, ad pondus specificum, ad saturationem; to a proper consistence, specific gravity, and saturation.

Donec (with subjunctive of verb) donec bullulæ excitentur, donec sit expers saporis, donec pellicula supernatet; until, bubbles are excited or produced, it is destitute of taste, a pellicle forms.

Per (with accusative) per dies quatuordecim, per horas duas; for, a fortnight, two hours.

(*b*)(*c*) Aliquando; sometimes. Aliquoties; for several times. Biduum, i; the space of two days. Bihorium; the space of two hours. Dies, ei; a day, used in the ablative case with the numeral adverbs, semel, bis, ter, &c., to express the number of times in a day; indies and quotidie also express daily; perendie, two days hence ; and hodie, to-day (ho(c)die). Dum; whilst. Hebdomada, æ; a week. Hora, æ; an hour, used in the singular number with the ordinals to express the time of day, or with the addition of quâque, every one, to express the return of any hour. Hora is also used with the ordinals and omnis, e; every, all, to express intervals of hours. Example: tertia hora; three o'clock; tertiâ quâque horâ, every third hour, or omnibus tertiis horis. Interim; in the mean time. Interdum; sometimes. Lux, lucis; light. Mane; morning, used with cras, to-morrow, and primo, early. Mox; immediately. Nox, ctis; night. Opus; need or want, used with the verb, to be, the thing required being put in the ablative case, it is often used with si, if, and quum, when, as si opus sit; if required. Quum opus sit; when required. Pridem or Dudum; heretofore. Post, after, and Ante, before, when prepositions, govern the accusative case and are frequently used with the following words, cibus, i; food: jentaculum, i; breakfast: prandium, ii; dinner: cœna, æ; supper: and horæ; hours, with the cardinals duo, tres, &c. But sometimes post and ante are adverbs, when they do not govern a case. Pro re nata; as circumstances arise; occasionally. Protinus, immediately. Raro, seldom. Sæpe, frequently. Sedes; an evacuation, as post singulas liquidas sedes, after each liquid evacuation. Statim, by-and-by, immediately. Subinde, now and then. Tamdiu, so long. Toties; so often. Tum, then. Vicis, pl. vices; course or time, used with ad, as, ad duas vices; for twice, or at twice taking, ad tertiam vicem for the third time—*i.e.* at thrice taking, or ad tertias vices. Si, if. Donec, until; likewise the ablative absolute, indirectly express time, as tussi ingravescente; the cough increasing: dolore torquente vel urgente; the pain being great or troublesome: si non dormiat; if he should not sleep: si (ubi) tussis increbuerit; if (when) the cough shall have increased: donec dolor exulaverit; until (such time as) the pain shall have removed: donec somnus obrepat; until sleep comes on.

Exercise I.

1. Ratio vel dosis drachma est. 2. Drachma pars octava unciæ est. 3. Recipe unciam. 4. Recipe magnesiæ sulphatis unciam cum semisse vel sesquiunciam. 5. Fiat mistura, cujus partem sextam capiat. 6. Fiant pilulæ duodecim quarum duas ter quaterve die capiat. 7. Haustus horâ somni sumendus. 8. Pilulæ duæ bis die sumantur. 9. Harum pilularum duæ statim sumendæ. 10. Cochleare modicum primo mane capiat. 11. Cochlearia duo ampla sumantur vel sumat. 12. Divide in pulveres sex, vel fiant pulveres sex.

Exercise II.

1. Confectionis Rosæ quantum sufficiat ut fiat pilula, quartâ quâque horâ sumenda. 2. Sumat unciam ter die. 3. Dosis pars sexta ter die. 4. Fiat mistura, cujus capiat partem sextam ter in die ex cyatho parvo aquæ. 5. Horâ secundâ post cibum sumatur. 6. Misce, fiat pulvis, omnibus sextis horis sumendus, in quovis vehiculo grato. 7. Sumat pilulas duas tertiâ quâque horâ. 8. Recipe Tincturæ Aurantii et Syrupi ejusdem ana drachmas quatuor. 9. Capiat cochlearia tria magna omni mane.

10. Sumat unciam, vel partem sextam misturæ, omni quâdrante horæ donec dolor exulaverit. 11. Cochlearia ampla duo sumenda, urgente flatu. 12. Cujus sumantur cochlearia tria magna post singulas liquidas dejectiones vel sedes.

EXERCISE III.

1. De quo (quâ f.) ad nucis moschatæ magnitudinem capiatur ter vel quater quotidie donec alvus commode purgetur. 2. Fiat pro haustu emetico, ut supra dandus. 3. Injiciatur horâ somni tertiâ quâque nocte ad tres vices; dein repetatur alternis noctibus usque ad quartam vicem si opus fuerit. 4. Cujus capiat cochleare amplum unum vel alternum ex poculo jusculi bovini. 5. Fiant lege artis; teneat sæpius in ore et manducet hujusmodi medicamentum expuatque salivam (expuo, ĕre, to spit out). 6. Fiat pulvis horâ somni per hebdomadam sumendus. 7. Fiat solutio ex cyatho aquæ perfrigidæ illico post solutionem sumenda. 8. E quibus sumantur binæ nocte maneque. 9. Camphoram primum cum spiritu in pulverem, tere, dein simul contunde et divide massam in pilulas viginti e quibus duæ sumantur. 10. Initio sumat æger pilulam unam mane nocteque, postea binas, deinde tres vel quatuor. 11. Macerā per horam in vase leviter clauso. 12. Misce et detur drachma cum semisse tertiis horis. 13. Recipe lactis vaccini bullientis octarium, aluminis drachmas duas; ebulliant simul fiat coagulum coletur serum et sumatur cyathus subinde. 14. Super linteum extende unguentum, vel unguento utatur super linteum. 15. Affricetur parti affectæ singulis noctibus. 16. Tempora fricentur; tempore fricandi. 17. Utendum cibis potionibus calidis. 18. Extremas partes oleo et sulphure perfricare. 19. Huic dolori lateris, calidis

fomentis uti. 20. Utile est miscere oleum cum hyoscyami et lini contritis seminibus. 21. Primo die abstinere ægrum oportet, secundo ducere alvum. 22. Sæpius eodem et die ante cibum et post eum. 23. Quin etiam quotidie ter quaterve opus est uti frictione vehementi pauxillo unguenti partibus iis. 24 Aquâ utendum est; aqua applicanda. (Utor. *see* page 28.)

Exercise IV.

1. Recipe Digitalis Foliorum exsiccatorum grana xxx.
    Aquæ Ferventis octarium dimidium.
  Macerā in vase clauso per horam unam et cola.
2. Recipe Tincturæ Tolutanæ guttas viginti.
    Syrupi ejusdem (Tolutani) unciam.
    Pulveris Tragacanthæ Compositi grana lx.
    Aquæ Aurantii Florum ad uncias quatuor.
  Misce, Fiat Mistura. Cujus cochleare magnum capiat tussi urgente.
3. Recipe Pilulæ Saponis Compositæ grana tria. Hora somni sumenda.
4. Recipe Pulveris Rhei grana decem.
    Potassæ Sulphatis grana xl.
    Liquoris Potassæ minima sex.
    Aquæ Menthæ Piperitæ unciam cum semisse.
  Fiat Haustus, quem primo mane sumat.

Prescriptions are rarely written in full; the initial letter of a very common word is used for the word; or the first syllable or more of those which are not so common, or which are likely to mislead.

The symbols ℥ for ounce, ʒ for drachm, ℈ for scruple, are mostly put instead of the words. The scruple and the drachm by weight should be expressed in grains.

NOTES.

A transitive verb governs an accusative case.

Example.—Grana xxx. cochleare magnum, unciam: governed by recipe, capiat.

Adjectives, &c., agree with their substantive in gender, number, and case.

Example.—In vase clauso, per horam unam. Syrupi Tolutani.

When two substantives of different meaning come together, that one on which the other depends is put in the genitive case.

Example.—Pulveris Rhei grana decem. hora somni. Liquor. Potassæ.

Words expressing time, when they answer to the question, when, are in the ablative case; but when they answer to the question, how long, they are in the accusative case; as primo mane, horâ (somni), per horam.

It must be remembered, that gerunds which govern the accusative may be turned into the participle in dus, da, dum, which agree with the nominative like adjectives of three terminations.

VULGAR FRACTIONS.

FRACTIONS are, as the name indicates, parts of unity, of an integer, or of a whole; by "fractions" is also understood the arithmetic which applies to their calculation.

Half may be taken as an example of a fraction, thus $\frac{1}{2}$; the figure above the line is called numerator, the one below the line denominator; together, they form the terms of the fraction. Three halves may be written $1\frac{1}{2}$, when the fraction is called a mixed number, or $\frac{3}{2}$ when it is an improper fraction, or it may be $\frac{3}{4}$ of 2, which is a compound fraction. The numerator may be regarded as a dividend, of which the denominator is the divisor, the result of the division being the fraction itself; for divide one by two, the quotient is $\frac{1}{2}$, or $\frac{1}{2}=2)\ 1\ (\frac{1}{2}$.

A fraction is increased in value when the numerator is multiplied by a *number*, or decreased in value or divided when its numerator is divided.

Ex.—In fractions of a shilling—

A Penny. Fourpence. Fourpence. A Penny.

$$\frac{1}{12}^{\times 4} = \frac{4}{12}, \text{ and } \frac{4}{12}^{\div 4} = \frac{1}{12}.$$

A fraction is divided or decreased in value when the denominator is multiplied by a *number*, and increased in value or multiplied when the denominator is divided.

Fourpence. A Penny. A Penny. Fourpence.

Ex. $\frac{4}{12\times 4} = \frac{4}{48}$, and $\frac{4}{48\div 4} = \frac{4}{12}$.

A fraction is not altered in value when both terms are multiplied or divided by the same number. The sixth part of a shilling is twopence, and two-sixths fourpence.

Fourpence. Fourpence. Fourpence. Fourpence.

Ex. $\frac{2\times 2}{6\times 2} = \frac{4}{12}$; and $\frac{4\div 2}{12\div 2} = \frac{2}{6}$.

Thus a fraction may be multiplied by a whole number by multiplying the numerator, or by dividing the denominator; and a fraction may be divided by a whole number by dividing the numerator, or by multiplying the denominator, by such whole numbers.

A whole number may be brought to a fraction with a given denominator, by taking unity as the denominator of the whole number, and then multiplying both terms by the given denominator.

Ex.—Reduce 4 to a fraction with 3 as a denominator; then $\frac{4\times3}{1\times3}=\frac{12}{3}$; and by dividing the numerator by the denominator, the improper fraction is brought again to a whole number, as $4=12\div3$.

MULTIPLICATION.

The product of several fractions is obtained by multiplying the numerators together for a new numerator, and the denominators together for a new denominator.

Ex.—Multiply one-half by two-thirds: $\frac{1}{2}\times\frac{2}{3}=\frac{2}{6}$ or $\frac{1}{3}$, or equal to $\frac{1}{2}$ of $\frac{2}{3}$.

Here it is evident that the product of two fractions is the fraction of a fraction, and that the value of a compound fraction is obtained by multiplication.

The example, moreover, shows that the product of two fractions is of less value than either the multiplied or multiplier: for if $\frac{1}{2}$ be multiplied by 1 or unity, the product is the fraction itself; but $\frac{2}{3}$ is less than 1, consequently the product of $\frac{2}{3}$ is less than that of unity: again, if the denominator 3 of the multiplier be suppressed, then $\frac{1\times2}{2}=\frac{2}{2}$ or unity; but it was not the product of 2 that was sought, but that of a number three times less than 2, therefore the product is three times too great, and should be $\frac{1}{3}$.

DIVISION.

Before applying the rule of division, mixed numbers must be brought to improper fractions, and compound fractions to simple ones.

The quotient of several fractions is obtained by inverting the divisor, and applying the rule of multiplication: that is, invert the divisor and multiply.

Ex.—Divide one-half by two-thirds: $\frac{1}{2} \div \frac{2}{3} = \frac{1}{2} \times \frac{3}{2} = \frac{3}{4}$; hence by division the value is increased, not diminished, for $\frac{3}{4}$ is greater than $\frac{1}{2}$ or $\frac{2}{3}$; and if $\frac{1}{2}$ be divided by 1, the quotient is the fraction itself, but $\frac{2}{3}$ is less than one, consequently the quotient of $\frac{2}{3}$ is greater than that of unity: again, if the denominator of $\frac{2}{3}$ be suppressed, then $\frac{1}{2 \times 2} = \frac{1}{4}$, but by the suppression of 3, the divisor was made three times too great, and therefore the quotient $\frac{1}{4}$ is three times too small, and should be $\frac{3}{4}$.

Complex fractions will offer no difficulty if division be understood.

ADDITION.

Let the fractions all have the same denominator, then add the numerators together for a new numerator, and take the denominator of one as the denominator to the new numerator, as $\frac{1}{6}\ \frac{2}{6}\ \frac{4}{6} = \frac{7}{6}$.

SUBTRACTION.

Let the fractions all have the same denominator, and subtract the numerator of one from that of the other of the required fractions, as $\frac{5}{6} - \frac{3}{6} = \frac{2}{6}$.

REDUCTION OF FRACTIONS.

To bring fractions so that they have the same denominator, required in addition and subtraction, and the process of bringing fractions to their simplest form, are called the reduction of fractions.

The value of a fraction is not altered by operating on both terms in the same manner and by the same number, so that fractions of the same value may occur with very different terms; their most simple terms are found by dividing both numerator and denominator by the highest number that will divide them without remainder; this number is called their greatest common measure, or divisor.

The greatest common measure of two numbers is found by dividing the larger number by the smaller, and this divisor again by the remainder, until there be no remainder; if it be impossible to obtain an exact division, the terms are prime, or in their first and simplest form, and are irreducible.

The greatest common divisor, or measure of several numbers, may be obtained by treating the greatest common measure of two numbers as one number, and taking down another number, proceeding as at first.

The process of simplifying fractions is shortened by employing smaller common divisors; but as it is necessary that both terms of the fraction should be exactly divided by the same number, it will be well to remember—that numbers are divisible, by 2 when they end in even numbers; by 4 when the last two figures are divisible by four; by 5 when the last figure is five or nought; by 6 when the last figure is even, and the sum of the figures is divisible by three, the latter indicates also their divisibility by 3: by 8 when the last three figures are divisible by 8; and by 9 when the sum is divisible by nine.

Ex.—Find the greatest common measure of 72 and 108, and give the simplest form of the fraction $\frac{72}{108}$.

Ans. 36, and $\frac{2}{3}$.

1st method:—

72) 108 (1
72

36) 72 (2 and $\frac{72}{108} \div \frac{36}{36} = \frac{2}{3}$.
72

..

2nd method:—

$\frac{72}{108} \div \frac{9}{9} = \frac{8}{12} \div \frac{4}{4} = \frac{2}{3}$, and 9×4=36.

Find the greatest common measure of 29472, 176832, and 1074. *Ans.* 6.

1st method:—

29472) 176832 (6
176832

......

1074) 29472(27
2148

7992
7518

474) 1074 (2
948

126) 474 (3
378

96) 126 (1
96

30) 96 (3
90

6) 30 (5
30

..

2nd method:—

2) 29472 176832 1074

3) 14736 88416 537

4912 29472 179

Ans. 2×3=6.

If we wished to calculate mentally the sum of one-half, two-sixths, and three-fourths of a shilling, we should mentally reduce each fraction to its value in pence, and then add the number of pence together for the result. This is the very principle followed in subtraction and addition of fractions; namely, bringing the terms to a common denominator and then operating on the numerators.

The method generally followed in reducing fractions to a common denominator is to multiply each numerator by the product of all the other denominators, except its own, for a new numerator, and all the denominators together for a common denominator.

Ex.—Add a fifth to a sixth ($\frac{1}{5}$, $\frac{1}{6}$) by multiplying both terms of $\frac{1}{5}$ by the other denominator, 6, the fraction is not altered in value, but the product is—$\frac{6}{30}$, and for the same reason $\frac{1}{6}$ multiplied by 5 becomes—$\frac{5}{30}$, but under these new conditions they both fulfil what was required in the rule, and their numerators now added give—$\frac{11}{30}$ as the result of adding $\frac{1}{5}$ to $\frac{1}{6}$. It will be often advisable to compare the denominators of such fractions and fix upon a common denominator, and multiply each denominator by a number which will make therewith the common denomitor, multiplying the numerator by the same number.

Ex.—Reduce the fractions $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ to a common denominator: here it is evident that the numbers 2×6; 3×4; 4×3 will give the common denominator 12, and that the numerators with the denominators will be the fractions $\frac{6}{12}$, $\frac{4}{12}$, $\frac{3}{12}$.

Fractions may be reduced to a common denominator also by taking the least common multiple of all the denominators for a common denominator, and multiplying each numerator by the number obtained by dividing the common denominator by its own denominator for a new numerator.

The least common multiple of several numbers is found by placing the numbers in a line and dividing as many as possible of them by the smallest number that will do so without leaving a remainder; then, place the quotients, and any numbers that were not divisible, in a line below, and proceed as at first with another number; continue the process as far as possible and multiply the divisors together, the product of which will be the least common multiple required.

Ex.—Find the least common multiple of 4 3 9 18.

$$\begin{array}{r|cccc} 2) & 4 & 3 & 9 & 18 \\ \hline 2) & 2 & 3 & 9 & 9 \\ \hline 3) & 1 & 3 & 9 & 9 \\ \hline 3) & 1 & 1 & 3 & 3 \\ \hline & 1 & 1 & 1 & 1 \end{array} \qquad \text{and } 2\times2\times3\times3=36 \text{ l. c. m.}$$

Again: since it is necessary to divide the common denominator by each denominator, the common denominator must be exactly divisible by each of the particular denominators. Now the simplest method of fulfilling this essential condition of divisibility is to take the product of all the denominators; for a product is always exactly divisible by each of its factors, and so a common denominator may be always procured; but in order that it may be the simplest common denominator, the denominators which are exactly contained in the others must be cancelled before multiplying the others for the product sought.

Ex.—Find the least common denominator of the following fractions:—

$\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{4}{15}$ $\frac{5}{6}$ $\frac{3}{8}$ $\frac{11}{24}$ $\frac{5}{24}$, then arrange and cancel thus,—

$\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{4}{3\times5}$ $\frac{5}{6}$ $\frac{3}{8}$ $\frac{1}{6}\times\frac{1}{4}$ $\frac{5}{24}$.

The denominators 2, 3, 4, 6, 8, are cancelled, for it is enough that 24 should enter into the composition of the product which makes that product divisible by all the factors of 24; the least common denominator then of the above fractions is 24 × 5, or 120. It is then applied as follows:—

$\frac{1}{2}\Big)\overset{\times 60}{\underset{60}{\underline{120}}}=\frac{60}{120}$ or $\frac{1}{2}=\frac{60}{120}$, for $120 \div 2 = 60$ and $1 \times 60 = 60$.

$\frac{2}{3}\Big)\overset{\times 40}{\underset{40}{\underline{120}}}=\frac{80}{120}$ or $\frac{2}{3}=\frac{80}{120}$, for $120 \div 3 = 40$ and $2 \times 40 = 80$.

$\frac{3}{4}\Big)\overset{\times 30}{\underset{30}{\underline{120}}}=\frac{90}{120}$ or $\frac{3}{4}=\frac{90}{120}$, for $120 \div 4 = 30$ and $3 \times 30 = 90$.

(*see rule*).

DECIMAL FRACTIONS.

To express numbers, however great, by only ten different characters, certain unities have been devised, which are from ten to ten times greater than simple unity. These are always represented by the same figures, but distinguished from one another by their place; and so to express numbers, however small, unity has been divided into parts from ten to ten times smaller than simple unity, and these are also distinguished from one another by their place. The divisions of simple unity are called decimal fractions, and are placed to the right of the entire numbers, being separated therefrom by a dot, called the decimal point; by moving this point towards the right, the number is increased according to the places passed over, for fractions are thus converted into whole numbers; by moving it towards the left the contrary takes place, for whole numbers are converted into fractions.

The decimal point is not put after whole numbers which are not followed by decimal fractions, yet it may be supposed to exist. To render the number 2 ten times smaller or of less value, the decimal point supposed to exist after 2 is put one place towards the left: thus, .2, or a hundred times smaller .02, &c., making up the places with noughts; to render 2 ten times greater or of more value, then by moving the supposed decimal point one place to the right, the result is obtained—thus 20.

ADDITION.

Whole numbers, as well as decimal fractions, increase in value by ten (times) as they are enumerated from right to left. Thus the rule of addition of decimal fractions must be the same as for whole numbers; care must, however, be taken that the decimal points of the numbers to be added are placed in the same column, and also that this point in the sum corresponds to or comes in the same column with the others.

Ex. $320 + 2.4 + .24 + .032 + .1 + 20.002 = 342.774.$

$$\begin{array}{r@{.}l} 320 & \\ 2 & 4 \\ & 24 \\ & 032 \\ & 1 \\ 20 & 002 \\ \hline 342 & 774 \end{array}$$

On inspection, it will be seen that noughts after decimal fractions, unless followed by a figure, do not alter the value: thus, .1 is equal to .10 or .100: hence each row in the preceding might be made up with noughts.

SUBTRACTION.

Subtraction of decimal fractions is performed in the same manner as that of whole numbers, since the unities borrowed are in both ten times the value of the inferior order, but when the decimal fractions are unequal in number noughts are added to make up the deficiency: $24.32 - 4.7632 = 19.5568.$

$$\begin{array}{r} 24.3200 \\ 4.7632 \\ \hline 19.5568 \\ \hline \end{array}$$

MULTIPLICATION.

The process of multiplying decimal fractions is the same as that of whole numbers, no attention being paid to the decimal points, except to mark off in the product as many decimals as there are in the multiplier and multiplied. *Ex.* .5 × .2 = .10.

If the decimal points were suppressed, .5 would become 5. and .2 would become 2.; that is, each would be increased in value ten times, and the product would thus be a hundred times too great; hence the necessity of marking off two decimal places in the product.

DIVISION.

The rule for dividing decimal fractions is the same as for whole numbers, but the decimal fractions must be made equal in number in the two terms with noughts, and the decimal points suppressed.

Ex. 196.8 ÷ 2.46 = 80; and 3.08 ÷ 2.2 = 1.4.

Noughts added to the right of a decimal number do not alter its value, then, by adding noughts in the following example the value is not altered, so by suppressing the decimal point each term is multiplied by the same number: therefore the quotient will be the same.

246.) 19680. (80 and 220.) 308. (1.4
1968 220
. . .0 88.0
88.0
. . .

It was necessary in the second example afterwards to increase the remainder ten times before complete division could be obtained; this was done by increasing 88 ten times, therefore the result would in part be tenths, namely .4.

A vulgar fraction may be converted into a decimal fraction by dividing the numerator by the denominator, and a decimal fraction may be converted into a vulgar fraction by taking the decimal as numerator, and for the denominator as many noughts as there are figures in the decimal, prefixing the unit 1.

$\frac{3}{4} = .75$, for $3. \div 4 = .75$, and $.75 = \frac{3}{4}$, for $\frac{75 \div 25}{100 \div 25} = \frac{3}{4}$.

It is rarely necessary to have more than three decimal places on account of the small value which others represent; rules for abbreviating decimals will be found in most works on arithmetic, also the method of converting recurring decimals into other fractions.

In the first and second of the following examples it should be noted that the understood numerator of the decimal fraction and the expressed numerator of the vulgar fraction are multiplied to bring the fraction to its equivalent in a lower term of value, and that these numerators are divided to bring the fraction to its equivalent in a higher term of value.

EXAMPLES.

1. $.48$ oz. $= 230.40$ min., for $.48 \times 8 \times 60 = 230.40$: or $.48 = \frac{48}{100} = \frac{12 \times 8 \times 60}{25} = \frac{5760}{25} = 230\frac{2}{5}$ min.

2. 230.40 min. $= .48$ oz., for $230.40 \div 60 \div 8 = .48$: or $230.40 = \frac{5760 \div 60 \div 8}{25} = \frac{12}{25} = .48$ oz.

3. One ounce to ten ounces is the formula of some of the infusions; required the number of grains in an ounce. $43\frac{3}{4}$ for 437.5 grs. (1 oz.) $\div 10 = 43.75$.

4. Water, the standard of density for solids or liquids, is taken as one or one thousand; a fluid ounce of distilled

water weighs 437.5 grs., an ounce of spirit weighs 366.625 grs.; required its specific gravity or relative density.

366.625 ÷ 437.5 = .838 s. g., *i.e.*, equal bulks, and weight of liquid divided by that of standard.

5. Required the weight of an ounce of spirit of which the specific gravity is .838.

1 : .838 :: 437.5 : 366.625; or $\frac{.838}{1} \times 437.5$.

6. What weight of ointment of aconitia contains a grain of aconitia? *Ans.* 58½ grs.

Form. Aconitia, 8 grs. Spirit, 30 minims. Lard, 1 ounce.

Spt. 22.914 (366.625 ÷ 16) + 8 + 437.5 = 468.414 grs. ÷ 8 = 58.55 grs.

7. Syrups are made to a given weight, and their specific gravity is mostly given; required the measure of 2½lbs. s. g. 1.335; also of one pound of castor oil, s. g. .941.

2½ lbs. = 40 oz.; ÷ 1.355 = 29.96 oz. and 16 ÷ .941 = 17.0 oz.

8. Required the weight of an ounce of syrup, s. g. 1.335.

1 : 1.335 :: 437.5 grs. : 584.0 grs.

The student must refer to tables for the amount of anhydrous acid or of alcohol in solutions of a given specific gravity, the ratio between the amount of salt in solution being irregular from contraction, mutual solution, and other circumstances.

Proof spirit is .928 s. g. A spirit is 1, 2, 3, &c. over proof when it is necessary to add so many volumes of water to a hundred volumes of the spirit, or 1, 2, 3, &c. under proof when it is necessary to add so many volumes of rectified spirit to a hundred volumes of the spirit. The amount of liquid to be added to bring a given quantity of spirit of which the under or over proof is known may be obtained by multiplying the quantity by the number under or over proof and dividing the product by 100.

9. How much rectified spirit must be added to 26 oz. 3 dm. 40 m. of spirit 5 under proof to make it proof?

26 oz. 3 dm. 40 min. × 5÷100 = 1 oz. 2 dm. 35 minims.

10. Water freezes at 32° Fahrenheit or at 0° Centigrade, and boils at 212 Fah. or at 100 Cent. 212 — 32 = 180, the ratio between F. and C. then is as 180 to 100, or as 9 to 5.

To convert C. into F. × 9÷5 + 32; or to convert F. into C. — 32 × 5 ÷ 9.

Alcohol boils at 173° F.; required the corresponding degree centigrade.

173 — 32 × 5 ÷ 9 = 78.3.

11. The most favourable temperature for etherification is between 127° and 154° C.: what are the corresponding degrees Fahrenheit? *Ans.* 260.6 and 309.2

12. The molecular weight of bicarbonate of soda is 84; required the percentage of sodium.

Formula. $NaHCO_3$ or Na (23) H (1) C (12) O_3 (48).

84 : 100 :: 23 : 27.38 or $\frac{23}{84}\times 100 = \frac{2300}{84}$ 27.38.

13. How many grains of iodate of potassium would be required for producing a hundred grains of iodide of potassium?

Formulæ. KIO_3 iodate or K (39) I (127) O_3 (48) and KI iodide or KI (166) $\frac{214}{166}\,\frac{\text{iodate}}{\text{iodide}}$ 214 × 100÷166=128.9 grs. or 166 : 100 :: 214 : 128·9.

14. The percentage composition of sulphuric acid being hydrogen 2.04, sulphur 32.65, oxygen 65.31: required its formula. Divide each percentage number by the atomic weight of its element and each of the quotients obtained by the lowest quotient, taking care that the relation is in whole numbers.

2.04 ÷ 1 = H 2.04. 32.65 ÷ 32 = S.1.02 65.31 ÷ 16 = 4.08, and these quotients divided by the lowest quotient give respectively 2.1.4. or $H_2 SO_4$.

Many of the quantities of materials mentioned in the first part of the synopsis may be ascertained by rules deduced from these examples.

15. Specific Gravity Bottle, 1000 grains (or other relative or definite quantity) of pure water at 60° F. contained; used for liquids of which it at once shows spec. grav., or for certain solids.

Solids.—Balance bottle and fill, powder a small quantity of the mineral, &c., weigh and place therein, remove all superfluous water, now take total weight.

Total weight—weight of solid = weight of remaining water, and original weight of water — remaining = weight of water escaped, and this, being equal in bulk to solid, taken as a divisor with weight of solid for dividend, we have the s. g. as quotient.

16. Specific gravity of solids heavier than water and insoluble therein.

Weight of body — weight in water, shows the loss, and loss being equal to weight of same bulk of water or standard, divide weight by loss, and the quotient is the s. g.

17. Specific gravity of solids lighter than water and insoluble therein. Absolute weight + levity = to weight of same bulk of water or standard, &c.

Ex. modified from Fownes.

Required specific gravity of wax from a piece weighing in air (*i.e.* absolute or ordinary weight) 133.7 grs.

Take a piece of brass as a sinker and weigh it in water it weighs 44.4 grs., attach wax, and again weigh in water, weight is 38.8 grs., hence, the levity or upward pressure is 5.6 (44.4 — 38.8) and 133.7 + 5.6 = 139.3, and 139.3, being weight of equal bulk of water to wax, taken as a divisor with dividend 133.7, we have the quotient or s. g. .959. ($44.4 - 38.8 = 5.6$ and $133.7 + 5.6 = 139.3$ and $133.7 \div 139.3 =$ s. g. 0.959).

Note.—Substances soluble in water must be weighed in some other fluid, of which the specific gravity is known, &c.; advisable to practice such calculations, also those pertaining to thermometric relations below zero.

THE METRIC SYSTEM.

THE terrestrial meridian is an imaginary line passing through the two poles of the earth, and is bisected by the equator, so that the arc between the pole and equator may be taken as a quarter of the meridian. To the ten millionth part of this arc the name of metre has been given. The metre is the base of the metric sytem.

Four prefixes used in this system and denoting decimal division are from the Latin; and four denoting decimal multiplication are from the Greek. These prefixes and their power are as follows:—

Myria.	Kilo.	Hecto.	Deca.		Deci.	Centi.	Milli.	Decimilli.
10000	1000	100	10	1	0.1	0.01	0.001	0.0001

The numeration of metrical numbers may *at present* be considered the same as that of decimals, but instead of abstract unity a definite measure is mentioned, thus 1^{m} .23, one metre, twenty-three hundredths, is read one hundred and twenty-three centimetres, or one metre twenty-three centimetres, or one metre two decimetres and three centimetres (1.23m, or 12.3 decim, or 123 cm.).

The point of a metrical measure may be altered without affecting the absolute value, the change being only one of denomination; thus 12^{dcam} .34 123^{m} .4 1234 dc.m. have the same value; for by the alteration of the point from left to right the numbers are multiplied each time by ten, but by their denomination according to the metric system they are divided each time by ten, consequently there is no alteration in value. Although the rules of decimals are followed in metrical calculations, in *subtraction* and *addition* the proposed numbers must be first brought to unities of the same order, that is, to the same denomination, which is effected by simply removing the point to the right of the required denomination: then $12^{m}.3 = 12300.mm$, for the place of mm is three to the right of m, and so $12300\ mm = 12^{m}.3$, for the place of m is three to the left of mm; sometimes noughts must be added or prefixed, as $12^{m}.3 = 0^{km}.0123$. Again $1\ m = 1000\ mm$ and $12^{m}.3 \times 1000 = 12300\ mm$: $1000 mm = 1 m$ and $12300\ mm \div 1000 = 12^{m}.3$.

If two metres be prefixed by deca or deci they would be increased or decreased tenfold; or if the denomination were retained and the decimal point altered, it is plain that the value would be decreased or increased, hence the value of metrical measures is altered when the denomination only is changed, or when the point is altered, the denomination being retained.

The student should make himself practically acquainted with metrical measures; the following approximations may give him some idea of their value:—A sixpence weighs three grammes, its thickness is a millimetre, its diameter two centimetres, or twenty millimetres, its diameter five times is equal to a decimetre, or the length of the middle finger, the middle fingers joined and five times their length taken is a metre; five paces are equal to four metres; a minute's walk will afford some idea of a hectometre, ten minutes' walk of a kilometre, &c.

It will be seen from the first and second examples following, that to convert an ordinary measure into a metrical measure, the ordinary measure is multiplied by the equivalent of its unity in metrical measure; and that to convert a metrical measure into an ordinary measure, the metrical measure is multiplied by the equivalent of its unity in ordinary measures.

The measures are not carried out to their full number of decimals.

Metre = 39.37 inches.
Gramme = 15.432 grains. = 1 cubic centim. pure water 4°C.
Inch = 2.53 cm. or 2^{cm} 53, or 253 dmm.
Grain = 0.0647 grm. or 0^{gm}.0647.
Litre = 1.760 pints; the measure of a kilogramme of pure water at 4° Centigrade. (*i.e.* max. density).

1. Express in grains the value of 12.5 cgms.

12.5 cgms. = .125 gms. × 15.43 = 1.92 grs.; or, $.125 = \frac{125}{1000} = \frac{1}{8} \times 15.43 = 1.92$.

2. Express in metres and in decimetres the value of the English yard.

36 in. × 2.53 = 91.42 cms. = 9.142 dms. = .9142 m.

3. What is the value of the metre in inches?

1 m. = 100 cms., and the number of times that 2.53 cms. (one inch) occur in 100 = 39.3 ins.

4. What is the weight of 4.5 lit. of water in grammes?

1 lit. = 1 kgm. × 4.5 = 4.5 kgms. = 4500 gms.

5. Add 12.3 kms. to .123 ms.

12.3 kms. = 12300 ms. + .123 m. = 12300.123 ms.

6. Required the cost of 34.3 gms. of opium, at 4.25 fr. per decagramme.

34.3 gms. = 3.43 dcagms. × 4.25 = 14.57 francs; or 34.3 × 4.25 ÷ 10 = 14.57.

7. What is the difference of 44.5 dgms. and .0751 kgms?

.0751 kgms. = 75.1 gms. 44.5 dgms. = 4.45 gms., difference being 70.65 gms.; or, 44.5 dgms. = .00445 kgms., and .0751 — .00445 = 70.65.

8. Write in figures, sixteen millimetres; eighty metres three hundred and thirty-four millimetres; two hundred metres seven millimetres; seven centimetres; three decimetres.

0^{m}.016; 80^{m}.334; 200^{m}.007; 0^{m}.07; 0^{m}.3; or 0.016 m. 80.334 m. 200.007 m. .07 m.

If the student does not clearly understand the foregoing, he had better read it over again before proceeding to square and cubic measure. He must not forget that there are two methods of reading the fractional part of a metrical quantity: thus, in the sixth example, the decagrammes are written 3.43 dcagms., meaning three decagrammes forty-three hundredths of a decagramme, or three decagrammes forty-three decigrammes, or 3 decagrammes, 4 grammes, 3 decigrammes. In French books on the metric system, 3.43 dcagrs. would be written 3 dcgrs. .43, and 4.25 francs 4 francs .25, .0751 kgms. 0 kgms. ·0751, &c.

SUPERFICIES.

The square of a rectangular surface is obtained by multiplying together its dimensions of length and breadth; the unity of small areas is the square metre, which is equal to a hundred square decimetres, for a square metre is a square of which each side measures a metre, or ten decimetres, and $10 \times 10 = 100$ s. dm. In like manner, a square decimetre is equal to a hundred square centimetres; whereby we find that the multiples and submultiples are obtained by removing the point, not one place but two, for the base of the numeration is now a hundred instead of ten: a square metre then is equal to 100 s. dm., or 10,000 s. cm., or 1,000,000 s. mm.

For large surfaces the unity is the *are*, or square decametre, with its multiple hectare or square hectometre.

Occasionally, to apply the calculations of the linear metre to the square metre, the latter is divided into parts or bands, each one having the length of a metre, but decreasing in breadth by ten, so that they represent tenths, hundreths, &c., of the square metre. For example: the tenth part of a square metre contains ten square decimetres, and is equal to a band one metre in length and one decimetre in breadth; the tenth part of a square decimetre contains ten square centimetres, equal to a band one metre in length, one centimetre in breadth, and if a band be one metre in length and one centimetre in breadth, it must be the hundredth part of the square metre, for ninety-nine centimetres would be required added to its breadth to make the breadth one metre; and the base of a row of such bands being one metre or a hundred centimetres linear measure, and their united breadths one hundred centimetres linear measure, their total area would be 100 × 100 s. cm.=10,000 s. cm.=100 s. dm.= 1 s.m.

There are two methods of expressing the multiples and submultiples of the square metre: for instance, 12345 s.m. .67899, or 12345.67899 s.m., starting from the point towards the left, we find on dividing the figures into pairs, that there are forty-five square metres, twenty-three square decametres, and one square hectometre; to the right of the point we find sixty-seven square decimetres, eighty-nine square centimetres, and a nought being added, ninety square millimetres: these numbers may be read—1 s. hm. 23 s. dcm. 45 s. m. 67 s. dm. 89 s. cm., 90 s. mm.; or, by the second system, twelve thousand three hundred and forty-five square metres, sixty-seven thousand eight hundred and ninety-nine hundred-thousandths of a square metre—*i.e.* 12345 $\frac{67899}{100000}$. Two places must always be assigned to each denomination: thus, one square metre two square decimetres would not he expressed by the figures 1.2 s.m. or $1^{sm}.2$ by either method; for as it stands by one method, it expresses one square metre and two-tenths, or twenty square decimetres, and by the other the 2 is the ten figure in the decimetre place, and nought for the unit being added would again make one square metre twenty square decimetres; hence the expression

1.02 s. m. or $1^{sm}.02$ is correct, being equal to one square metre two square decimetres, or one square metre and two hundredths of a square metre.

Metre s. (2. Q. or carré) $=10.7642$ s. ft.

Inch s. $= 6^{s.\ cm}.451$, or 6.451 scm. or 6 cm^2 45 mm^2 10 dmm^2.

1. What is the value of 1^2 ft. in dm^2?

$6.45\times 144=928^{cm^2}=9.^{dm^2}289=09.\ dm^2 28\ cm^2 90\ mm^2$

$=9\frac{2890}{10000}$ s. dm.

2. A surface is 4 m × $12^m.5$, how many cm^2 does it contain?

$4\times 12.5=50\ m^2$ or $500000\ cm^2$ or $4\times 12.5\times 100\times 100$.

3. Express $42m^2$ and 2 dm^2 in $dcam^2$ and cm^2.

$42\ m^2 02 dm^2$, or $42.02\ m^2=420200 cm^2=0^{dcam^2}.4202$, or $42.02\times 100\times 100$ and $42.02\div 100$, &c.

4. Write in figures 1 square hectom. 2 square metres 3 square millimetres.

$10002.000003m^2$; or $01.\ hm^2\ 00 dcam^2 02\ m^2 00 dm^2\ 00\ cm^2 03\ mm^2$; or $10002\ m^2\ 00\ dm^2\ 00 cm^2$, &c.

5. How many $dcam^2$ are there in 874000415 mm^2?

There are 8.74000415 $dcam^2$, or 8 $dcam^2$ $74m^2$ 0004 cm^2, &c.

6. Read $4m^2.002004.=4m^2 002004\ mm^2$.

$4\frac{002004}{1000000}m^2=4m^2 20\ cm^2\ 4\ mm^2=04, 00, 20, 04.$

7. Product of 5 and another number is 23 m^2 40 dm^2, required the unknown number.

$23.40 \div 5 = 4\ m^2\ 68\ dm^2$.

8. Required the difference of 14 $myrm^2$ 15 $kilom^2$ and 9.27 $myrm.^2$

$14.15 - 9.27 = 4\ myrm^2\ 88\ km^2$, or 488 km^2.

9. What part of the square metre are 80 dm^2?

$80\ dm^2 = .80\ m^2 = \frac{4}{5}$.

10. Required the cost of 1 m^2 the cm^2 being 0 fr. .01.

$.01\times 100\times 100 = 0100.$ or 100 fr.

11. A dm^2 costs 2 fr., required the cost of the cm^2 and of the mm^2.

$2 \div 100 = 0$ f. 02 c. the cost of the $centimetre^2$ and $0.02 \div 100 = 0$ f. 0002.

12. Proportion between diameter and circumference of a circle is as 7 : 22. Area of circle; diameter squared $\times 0.785938$, or circumference $\times \frac{1}{4}$ of diameter, or radius squared $\times 3.1416$. Circumference of a circle, diameter $\times 3.1416$. Diameter of a circle, circumference $\div$ 3.1416. Surface of a sphere, diameter squared $\times 3.1416$. Area of triangle. Height × Base $\div 2$. Area of rectangle, square, rhombus, and rhomboid, height × base.

13. Required the area or surface of a circle 24 metres diameter.

The circumference is 75 m. 3984 (or 24×3.1416), the fourth of the diameter is 6 m. ($24 \div 4$) and the surface is 75 m. 3984, circum. × 6 quart. diam. $= 452m^2\ 3904 = 452m^2\ 39\ dm^2$, &c.

14. The sum of 402 fr. has been paid for a triangular area having base 15 m. height 10 m., what has been paid per metre?

Surface $= 75m^2$ for $15 \times 10 \div 2 = 75$, and the cost is 5 f. 36 centimes for $402 \div 75 = 5.36$.

15. How many tiles would be required to cover a surface 12 m. long, and 10 m. 75 cm. wide, each tile being 25 cm. long 15 cm. wide?

$12 \times 10.75 = 129m^2$; $25 \times 15 = 0.m^2 0375$; and $129 \div 0.0375 = 3440$ tiles.

16. Caution.—Are 100 square centimetres equivalent to 10 centimetres square?

SOLIDS.

Solids or volumes have dimensions of height, length, and breadth; by multiplying these together the contents of a rectangular measure or solid may be obtained; the unity of volume is a cubic metre which is equal to a thousand cubic decimetres, for a cubic metre has length, breadth, and height, each the measure of a metre or ten decimetres, and 10×10×10=1000, in like manner the cubic decimetre is equal to a thousand cubic centimetres, whereby we find that the base of the numeration is now a thousand, and that the multiples and submultiples are obtained by removing the point three places for each denomination, thus:—

A cubic metre=1000 c. dm.=1000000 c. cm.=
1000000000 c. mm.

The cubic metre is called a stere when applied to the measurement of wood, &c.; a cubic decimetre is called a litre, and is the measure of liquids, &c.; but the submultiples of the stere and litre are not cubical multiples, but decimal, and therefore decastere and decalitre, &c., are terms improperly used; they should be called ten steres, ten litres, &c.

To apply decimal calculations to the cubic metre the latter is divided into parts, each having the square metre as a base, the height or thickness only decreasing by ten, so that these parts represent tenths, hundredths, &c. of the cubic metre: thus there are two methods of expressing the cubic metre and its multiples and submultiples—for example, 12345.6789 cubic metres; starting from the point towards the left, dividing the figures into ranks of three, we find 345 c. m. 12 c. dcam., and to the right of the point we find 678 c. dm.; adding noughts to the nine which is in the place of hundreds, we have 900 c. cm., or, according to the second method, twelve thousand three hundred and forty-five cubic metres, six thousand seven hundred and eighty-nine ten thousandths of a cubic metre; or $12345\frac{6789}{10000}$ cubic metres: three places must be assigned to each denomination—thus 1.2 cubic metre would not express one cubic metre two cubic decimetres, for by one method it stands as two-tenths of a cubic metre, equal to 200 cubic dm., and by the other it is in the place of hundreds, and noughts added would likewise make 200 cubic dm., the correct expression is 1.002 c. m., or $1^{m^3}.002$, or $1\frac{2}{1000}$ cubic metre.

The litre is the unity of measures of capacity, and is equal to the capacity of a cubic decimetre; the litre measure for convenience is made cylindrical.

Metre cubic, or metre^3=35,3165 cubic feet.

Litre=decim^3=1.7607 pints=61.0270 cubic inches.

Inch cubic = 16.3861 cm^3.

1. Express in pints the dcali, dli, and cli.

1 dcali.=17.60 pints, 1 dli.=.1760 pint, 1 cli. =.01760 pint.

2. Express 12.34 li. in hli., and their value in pints.

12.34li.=.1234hli., and 12.34li. × 1.760=21.7

3. What denomination of litres is equal to a cubic metre, and what would it be were cubic measure followed?

1 li.=1 dm^3, and 1 li. × 10 × 10 × 10=1 kli; 1 dm^3 × 1000=1 m^3; hence 1 m^3=1 kli.; but by cubic measure 1 dcali.=1 m^3.

4. Express 42 m^3, 2 dm^3, in dcam^3 and dm^3.

42 m^3 002 = 42002 dm^3 = 0. dcam^3 042002; or, 0 dcam^3 042 m^3 002 dm^3.

5. Write in figures 1 hm^3, 2 m^3, and 3 mm^3.

1000002 m^3 000000003=1 hm^3 000 dcam^3 002 m^3 000 dm^3 000 cm^3 003 mm^3.

6. What is understood by 12 m^3 467839?

12 m^3 467 dm^3 839 cm^3; or, 12 m^3 467839 cm^3; or, 12 m^3 $\frac{467}{1000}$, &c.

7. How many mm^3 in 39 dm^3?

39000000 mm^3, for 39 × 1000 × 1000=&c.

8. Required the cost of 4 m^3 125 dm^3 200 cm^3 at 150 fr. the m^3.

4 m^3 1252 × 150=618 fr. 78.

9. How many cm^3 are equal to 20 dli.?

20 dli. = 2000 cm^3, for 2 li. = 2 dm^3, and 2 × 1000 = 2000 cm^3.

10. How many hli. in 17m^{3}425?

17m^{3}425 = 174 hli. 25 li., for 17m^3.425 = 17425 dm^3 = 17425 li. = 174 hli.

11. Let a measure 1 cm. × 5 cm. × 100 cm. be called a school metre, what are the contents of the school metre, and its relation to the m^3?

1 × 5 × 100 = 500 cm^3 = 0m^3.000500, and $\frac{0005}{10000}$ = $\frac{1}{2000}$ m^3.

12. Required the weight of 9 li. 4 of water, and the cube of a vessel which contains 40$^{\text{kgm.}}$.45.

Weight of water, 9$^{\text{kgm}}$. 4. Volume of vessel, 40 dm^3 450 cm^3 (1 li. = 1 dm^3 = 1 kgm.)

13. Required the weight of 12 m^3 678 dm^3 of water.

12m^{3}678 = 12678 kgms. for 1 dm^3 = 1 kgm. and 12m^3 .678 = 12678 dm^3.

14. To obtain the volume of a cube, area of base × height; of a cylinder or prism, area of base × height; of a sphere, surface × $\frac{1}{3}$ of radius; or diameter cubed, × 0.5236.

15. Required the volume of a sphere 36 m. circum.

36 ÷ 3.1416 = 11.46 diameter, and 11.46 cubed = 1505.060; this × 0.5236 = 788 m^3 049 dm^3 487 cm^3 209, &c.; or, 36 × 11.46 = 412 m^2 56 dm^2, surface × 1.9 ($\frac{1}{6}$ of diam. = $\frac{1}{3}$ of radius) = 787 m^3 989 dm^3, &c.

16 Required the volume of a cylinder 8 m. high, area of base 2 m^2.

8 × 2 = 16 m^3.

17. Required the volume of a cylinder having 2 m. radius and 12 m. height.

(2 m. rad. = 4 m. diam.) × 3.1416 = 12 m^2 5664 cm^2; area of base × 12 m. height = 150 m^3 796 dm^3 800 cm^3.

18. Required the cost per cubic metre of a block of marble which is 4 m. high, 3 m. long, 2 m. wide, and which cost 720 fr.

$4 \times 2 \times 3 = 24$, and $720 \div 24 = 30$ fr.

19. In 616 m^3 how many hectolitres and litres?

616 m^3 = 616000 dm^3 or litres = $6160^{hli}.00$.

These problems should also be carefully worked out in English measure by the student. In reducing measures to weights or weights to measures, density and temperature must ever be remembered.

20. Gas.—Pressure increased so volume diminished, and *vice versâ.*

Required vol. of 10 vol. 28 in. bar. at 30 in. bar. Press. increased vol. dim. then 30 : 28 : : 10 : $9\frac{1}{3}$.

21. Gas.—Vol. increased or diminished by temperature. 273 vols. become 274 at 1° C. etc. above and below 0° C.

Required vol. of 10 vols. at 20° C. when at 30° C. Temp. inc. vol·inc. 273 + 20 : 273 + 30 : : 10 : 10.34; or 273 + given temp. : 273 + required temp. : : given vol. : required vol.

22. Gas.—Affected in volume by temp. and pressure.

Required vol. of 50 vols. 12° C. at 750 m.m. bar. when at 20° C. and 800 m.m. bar. (see unit of inch).

Temperature increased then volume increased.

273 + 12 : 273 + 20 : : 50 : 51.40.

Pressure increased vol. diminished and

800 : 750 : : 51.40 : 48.19 or $\frac{293 \times 750 \times 50}{800 \times 285} = 48.19$.

Name, &c.	*Plant.*	*Natural Order.*	*Country.*	*Chief Characters.*	*Adulteration, or Substitution.*
Acaciæ Gummi (stem exudation)	Acacia vera	Leguminosæ	E. Africa	Brittle, colourless tears, soluble in water, insoluble in alcohol. Solution in boiling water when cold not turned blue by iodine. Gum principle arabin (gummate of lime), precipitated by alcohol and acetate of lead.	Starch. Brown inferior gums, tough and less soluble. Dextrin, not precipitated by neutral iron perchloride.
Aconiti Folia (fresh)	Aconitum Napellus Monkshood	Ranunculaceæ	Gt. Britain	Fresh leaves and flowering tops.	
Aconiti Radix (dried)		„	Germany	Dry blackish-brown roots, rapidly tapering; rootlets; int. whitish. A few inches long; no smell; acrid.	
Aloe Barbadensis (dried leaf-juice)	Aloe vulgaris	Liliaceæ	Barbadoes	Brown bitter masses becoming black; nearly soluble in proof spirit. Strong disagreeable sea odour. Aloes yields about 80 per cent. extract. Fracture dull, unequal, roughish; powder dirty yellowish-red.	Resin. Ochre, detected by water, ignition, incineration.
Aloe Socotrina (dried leaf juice)	Aloe socotrina	„	Socotra	Reddish-brown bitter masses; soluble in proof spirit. Rare. Aromatic myrrh-like odour. Fracture smooth, conchoidal, glazed; powder golden yellow.	Inferior sorts; empyreumatic, nauseous, strong. Cape Aloes (Socotrine), blackish-brown glistening green, opaque in mass, red and translucent in thin laminæ, fracture vitreous, powder greenish-yellow.
Ammoniacum (stem exudation)	Dorema Ammoniacum	Umbelliferæ	Persia. Punjaub	Brittle masses or tears; fracture white and smooth; bitter, acrid; odour faint and unpleasant. Gum-resin.	
Amygdala Amara (seed)	Amygdalus communis (var. amar.)	Rosaceæ	Mcgadore	Bitter almond. Brown-coated kernels; prussic acid odour when rubbed with water. Oleum s. g. .917, expressed.	
Amygdala Dulcis (seed).	Amygdalus communis (var. dulc.)	„	Malaga	Sweet almond. No prussic acid odour; larger than the bitter almond. Oleum s. g. .917, expressed.	
Amylum (wheaten starch)	Triticum vulgare	Graminaceæ	Gt. Britain	A cold decoction gives with iodine a blue colour, which is destroyed by heat. Granules smaller than those of potato starch.	
Anethi Fructus (fruit)	Anethum graveolens—Dill	Umbelliferæ	„	Oval, flat, length a line and a half. Margin membranous, pale. Convex side bright brown.	
Anethi Oleum	„	„	„	Pale yellow, acrid, pungent, sweetish.	

Name, &c.	*Plant.*	*Natural Order.*	*Country.*	*Chief Characters.*	*Adulteration, or Substitution.*
Anisi Oleum— British	Pimpinella Anisum	Umbelliferæ	Gt. Britain	Colourless or pale yellow, peculiar odour, concretes at 50°. Soluble in cold spirit. It consists of anise camphor $C_{10}H_{12}O$ dissolved in a fluid oil having the composition of turpentine.	Spermaceti, insoluble in spirit; Camphor known by its smell.
Chinese	Illicium anisatum	Magnoliaceæ	China		
Anthemidis Flores (dried sgl. and dbl. flower heads)	Anthemis nobilis Chamomile	Compositæ	Gt. Britain (Belgian Hops E. Brewers)	Sgl. flts. yellow and tubular, or white and strap-shaped, receptacle conical. Dbl. flts. white strap-shaped, receptacle conical, scaly, and chaffy. Bitter but aromatic. Oleum.	Feverfew. sgle. recep. flat. dble. recep. conical, seeds few, scarcely chaffy. Disagreeable odour.
Armoraciæ Radix (fresh root)	Cochlearia Armoracia	Cruciferæ	Gt. Britain	Horseradish yellowish-white, does not taper rapidly, pungent, aromatic.	
Arnicæ Radix (dried rhizome and rootlets)	Arnica montana	Compositæ	S. Europe	Dry twisted scaly rhizome, 3 inches long, rootlets attached. Peppery taste; odour peculiar.	
Assafœtida (gum resin from root)	Narthex Assafœtida	Umbelliferæ	Affghanistan. Punjaub.	Opaque masses, fresh fracture white, speedily changing to pink. Not brittle; bitter, fœtid; nearly soluble in spirit. Gives with nitric acid styphnic acid (picric acid with an atom of oxygen). It yields 50 per cent. resin, and 8 per cent. of a volatile oil.	Sand. Flour. Gypsum, &c. Resin.
Aurantii Cortex (dried outer rind)	Citrus Bigaradia	Aurantiaceæ	S. Europe	Orange peel; thin, bitter, aromatic, fragrant, ought not to have much inner rind.	
Balsamum Peruvianum (stem exudation)	Myroxylon Pereiræ	Leguminosæ	Salvador C. Amer.	Consistence of syrup; blackish-red; no diminution in volume when mixed with water, nor separation into layers when dropped therein; miscible with spirit. The brown solid sort is not officinal.	Alcohol, fixed oils, artificial balsams, *i.e.* resin, benzoin, and volatile oils.
Balsamum Tolutanum (stem exudation)	Myroxylon Toluifera	„	New Granada	Soft, tenacious, solid, fragrant odour altered by caustic potash; soluble in ether and spirit. Formerly hard and strong. It yields by distillation benzoic acid, cinnamein and tolene.	Resin; sulphurous acid given off on addition of sulphuric acid, liquid becoming black.
Belæ Fructus (dried half-ripe bael fruit)	Ægle Marmelos	Aurantiaceæ	Malabar. Coromandel	Resemblance to pomegranate, hard woody greyish rind, inside with pulp often cherry red.	
Belladonnæ Folia (fresh leaves & branches or dried leaves)	Atropa Belladonna. Deadly Nightshade	Solanaceæ	Gt. Britain	Entire leaves, infusion or juice dilates the pupil. A. p. Atropia.	

(dried)	**donna. Deadly Nightshade**			lates the pupil.	
Benzoinum (concreted stem exudation) Resin 80 B. Acid 10 per cent.	Styrax Benzoin	Styraceæ	Sumatra. Siam	Mottled masses brown and white, rarely in tears; not black, soluble in ether, spirit, and caustic potash, odorous. Sumatra benzoin imported in calico wrappers.	Benzoin deprived of its acid; does not furnish ten per cent. of acid. (Wet process.)
Buchu Folia (dried)	Barosma betulina B. crenulata B. serratifolia	Rutaceæ	Cape of Good Hope.	Leaves serrated from ¾ to 1 inch long. B. sharp spreading teeth; C. five nerved; S. three nerved. (*See* Botany.)	
Cajuputi Oleum (distilled from leaves)	Melaleuca minor	Myrtaceæ	Singapore Batavia	Pale bluish-green, strong agreeable aromatic odour. Soluble in spirit.	Rarely, camphor, oil of rosemary, or copper.
Calumbæ Radix (dried transverse slices)	Jateorrhiza Calumba. Cocculus palmatus	Menispermaceæ	E. Africa	Greyish yellow, with a dark concentric line, diam. 2 inches. Bitter, brittle; no tannin.	Bryony-root. American Calumba.
Cambogia (gum-resin)	Garcinia Morella	Guttiferæ	Siam	Red brittle cakes or pipes; yellow on addition of water; nauseous, bitter; nearly soluble in spirit or ether.	Starch, green colour on addition of iodine. Non-emulsive resins.
Camphora (concrete volatile oil from the wood)	Camphora Officinarum	Lauraceæ	China. Japan	White clear tough masses; sublimed by heat. Soluble in oil and spirit. $C_{10}H_{16}O$. Strong odour. Bornese, rare; heavier than water; friable.	Artificial Camphor, burns with sooty flame giving off turpentine odour. Sal ammoniac, mix with warm lime, &c. Microscopical tests also.
Canellæ Albæ Cortex	Canella alba	Canellaceæ	W. Indies	Yellowish white quills, acrid, aromatic, hot. It does not contain tannin.	
Cannabis Indica (dried flg. tops of female plants)	Cannabis sativa	Cannabinaceæ	India	Indian hemp or bang. Alternate branches, remains of leaves, flowers, and fruit dusky green; odour characteristic.	
Capsici Fructus (dried ripe fruit)	Capsicum fastigiatum	Solanaceæ	Guinea. E. and W. Indies	Straight orange-red smooth pods; ½ inch long. Intensely hot.	
Cardamomum (dried capsules; the seeds only are used)	Elettaria Cardamomum	Zingiberaceæ	Malabar	Husks pale brown, tough. Seeds reddish brown, angular; internally white; aromatic.	
Carui Fructus	Carum Carui	Umbelliferæ	England Germany	Caraway fruit.	
Caryophyllum (dried flower buds)	Caryophyllus aromaticus	Myrtaceæ	Penang. Bencoolen. Amboyna	Cloves. Brown and oily; ½ inch long; four teeth surrounding globular head; oil emitted when indented with the nail. Oleum.	Cloves freed from their oil.
Cascarillæ Cortex (dried)	Croton Eluteria	Euphorbiaceæ	Bahamas	Brown quills, fragrant odour when burned.	
Cassiæ Pulpa (pulp from the pods	Cassia Fistula	Leguminosæ	E. and W. Indies	Blackish-brown, viscid, sweet pulp, containing seeds and dissepiments.	

Name, &c.	*Plant.*	*Natural Order.*	*Country.*	*Chief Characters.*	*Adulteration, or Substitution.*
Catechu Pallidum (extract of leaves and shoots)	Uncaria Gambir.	Cinchonaceæ (Cat. nig. Leg.)	Singapore E. Archipelago	Brown cubic masses; earthy fracture: bitter. Soluble in boiling water; cold decoction not rendered blue by iodine. Ether dissolves 50 per cent. residuum of catechu and tannic acid.	Starch. Earth.
Cerevisiæ Fermentum (beer yeast)				Insoluble in water; transparent, coherent globules; it contains two species of fungi.	
Cetraria (entire lichen)	Cetraria islandica	Lichenes	N. Europe	Iceland moss. Lobed brownish-white thallus, pale beneath. Strong decoction gelatinous when cold; precipitated by alcohol, acetate of lead, and infus. of galls.	
Chirata (entire plant)	Ophelia Chirata	Gentianaceæ	N. India	Stem round, smooth, 3 ft. long; branches opposite; flowers small; intensely bitter.	
Cinchonæ Flavæ Cortex	Cinch. Calisaya	Cinchonaceæ	Bolivia, S. Peru	Flat uncoated pieces, rarely coated quills; outer surface brown, inner surface tawny yellow; fibrous; very bitter.	
Cinchonæ Pallidæ Cortex	Cinch. Condaminea	"	Loxa	Brittle quills, outer surface brown or grey; inner surface cinnamon brown; slightly bitter.	
Cinchonæ Rubræ Cortex	Cinch. succirubra	"	Chimborazo	Flat-coated pieces, brown; outer surface with transverse cracks; bitter.	
Cinnamomi Cortex (inner bark of shoots)	Cinnamomum zeylanicum	Lauraceæ	Ceylon	Closely-rolled brown quills; spicy, sweet, aromatic taste; fracture splintery; infusion not turned blue by iodine. Oleum sinks in water.	Cassia; pieces simple thick, fracture straight; infusion turned blue by iodine. (Useful only by comparison.)
Colchici Cormus (fresh and dried)	Colchicum autumnale	Melanthaceæ	Gt. Britain	Corm size of chestnut; dried slices whitish, firm, flat, and amylaceous.	
Colchici Semina	"	"	"	Size of mustard seed; hard; reddish-brown.	
Colocynthidis Pulpa (dried decorticated fruit freed from seeds)	Citrullus Colocynthis	Cucurbitaceæ	Smyrna. France Spain. Trieste.	Light, spongy, yellowish-white, very bitter.	
Conii Folia (fresh leaves and young branches or dried leaves)	Conium maculatum	Umbelliferæ	Gt. Britain	Divided leaves; odour of conia when rubbed with solution of potash. A. princ. conia; a volatile, oily liquid.	
Conii Fructus (dried, ripe fruit)	"	"	"	Broadly ovate; 5-waved ridges; odour of conia when rubbed with potash.	Ft. of Æthusa, &c.

Copaiba (oleo-resinous exudation) Copaibæ Resina (now in use)	Copaifera multijuga, &c.	Leguminosæ	Amazon	Peculiar odour. S. g. .950 to 1.000; soluble in spirit; is not gelatinous after 270°. Drops in water take a spherical form. Solution of ammonia and double its bulk of copaiba form a mixture which becomes clear and remains so. Soluble in a volume of benzol. Oleum.	Gurjun balsam gelatinous at 270°. Fixed oils; almost insoluble in spirit (except castor-oil). Exposed by long boiling in water.
Coriandri Fructus (dried ripe fruit)	Coriandrum sativum	Umbelliferæ	Gt. Britain	Size of white pepper; ribbed; yellowish-brown; aromatic. Oleum.	
Creasotum (product of the distillation of wood tar)				Colorless liquid, strong tar odour; soluble in ether, alcohol, acetic acid one volume and caustic potash; coagulates albumen. S. g., 1.071. Dissolved by a hundred parts of water. Dropped on white filtering paper and exposed to a heat of 212° no translucent stain.	Fixed and volatile oils. Impure creasote turns brown on exposure to air. Carbolic acid, glyc. test doubtful.
Crocus (dried stigma and part of style)	Crocus sativus	Iridaceæ	Naples. Spain. France	Thread-like styles having three orange brown stigmas; no oily stain when pressed between paper. Saffron.	Water, oil, safflower tubular corolla, five teeth. Marigold petals disagreeable odour when burned.
Crotonis Oleum	Croton Tiglium	Euphorbiaceæ	Hindostan Ceylon	Brownish-yellow; slightly viscid; acrid taste; faint nauseous odour; soluble in ether and oils.	Castor-oil, more viscous, fixed oils insol. in alc. of s.g. 952.
Cubeba (dried unripe fruit)	Cubeba officinalis	Piperaceæ	Java	Stalked, wrinkled; size of black pepper; peculiar taste and odour. Oleum colourless or pale greenish-yellow.	
Cuspariæ Cortex (angustura bark)	GalipeaCusparia	Rutaceæ	S. America	Straight, incurved pieces; edges sharp; epidermis loose, mottled, yellowish-grey. Inner surface touched with nitric acid does not become blood-red. Bitter.	Nux vomica bark is turned blood-red when touched with nitric acid.
Cusso (flowers and tops)	Brayera anthelmintica	Rosaceæ	Abyssinia	Small reddish flowers on hairy stalks; calyx five parted, segments veined.	
Digitalis Folia (dried)	Digitalis purpurea Foxglove	Scrophulariaceæ	Gt. Britain	Ovate; lanceolate; shortly petiolate; crenate; lateral veins deeply inserted. A. p. Digitalinum soluble in spirit.	Compare comfrey, primrose, scrophularias, inulas. Note emergence of lateral veins, also margins.
Dulcamara (dried young branches)	Solanum Dulcamara Bitter-sweet	Solanaceæ	"	Light; hollow; thickness of a goose quill; bitter; afterwards sweet.	
Elaterium (sediment from juice)	Ecbalium Officinarum	Cucurbitaceæ	"	Small, thin, greyish-green cakes; fracture granular; yields half its weight to boiling spirit; does not effervesce with acids.	Chalk; starch which also occurs naturally.
Elemi (resinous exudation)	Canarium commune	Amyridaceæ	Manilla	Unctuous; brittle when dry; fennel odour; soluble in spirit.	

Name, &c.	*Plant.*	*Natural Order.*	*Country.*	*Chief Characters.*	*Adulteration, or Substitution.*
Ergota (mycelium or spawn)	Secale cereale	Graminaceæ	Gt. Britain	One inch in length; triangular; surface violet-brown; furrow on concave side; fracture short; faint odour; yields one-third of an oil.	Renew stock that may be crumbly from mites.
Farina Tritici (ground grain sifted)	Triticum vulgare	„	„	Wheaten flour; it consists of gluten, starch, sugar, gum, water, with phosphates, &c. Ash 2°/₀. Gluten 25–34°/₀. Gluten (dry) 8–11°/₀. Starch 60–72°/₀. Starch grains under mic. lenticular (and flat), those of rye about the same form and size.	Potato starch, heavier, larger, oblong, cross-like marking underpol. light (hence rapid or imperfect decantations and microscope). Maize Rice; heavier, polyhedric, débris of perisperm ang. maize, yellow with weak potass sol. Rye, glut. dark viscous, starch often with central stellate rays. Legum. glut. O. on passing through cloth; cell tissue hex. reticul., starch, not flattened, central linear cleft (ragged).
Ficus (dried fruit) (syconus)	Ficus Carica Fig tree	Moraceæ	Smyrna		
Filix Mas (rhizome rootlets and base of footstalk dried)	Aspidium Filix mas Male Fern	Filices	Gt. Britain	Tufted, scaly, greenish-brown; disagreeable odour and taste.	
Fœniculi Fructus	Fœniculum dulce Fennel	Umbelliferæ	Malta	Three lines long, one broad; elliptical; eight pale-brown ribs, two lateral double. Aromatic.	
Galbanum (gum resin)	Galbanum officinale	„	India. Levant	Greenish-yellow agglutinated tears; disagreeable odour and taste. Soluble in proof spirit. 60 per cent. resin, 10 per cent. gum, and 6 per cent. volatile oil.	
Galla (excrescences)	Quercus infectoria	Cupuliferæ	E. Indies. Asia Minor.	Hard, heavy, globular bodies; diameter ½-inch; tuberculated surface. At least 30 per cent. of tannic acid; infusion precipitates, gelatine, alkaloids, mineral salts.	Test percentage of tannin by exhausting with ether, &c. Supplement the test by the following volumetric one. Precip. infusion by tartar emetic sol. (20 grs. of tan. precip. by 14 grs. of tartar emetic).
Gentianæ Radix (dried)	Gentiana lutea	Gentianaceæ	Alps. Apennines	Several inches long; brown without, yellowish within; taste sweet, afterwards bitter.	
Glycyrrhizæ Radix (underground stem fresh and dried)	Glycyrrhiza glabra	Leguminosæ	Gt. Britain	Long cylindrical pieces; branched; outside greyish-brown; sweet and mucilaginous. Liquorice root.	
Gossypium (carded hair of seeds)	Gossypium herbaceum	Malvaceæ	America, &c.	Cotton.	

	Pomegranate			gives yellow precipitates with isinglass, potash, ammonia, and perchloride of mercury.	Barberry, yellow, very bitter; see also reagents.
Guaiaci Lignum	Guaiacum officinale	Zygophyllaceæ	Jamaica. St. Domingo	Yellowish-white and greenish-brown chips; green turned to blue by nitric acid or chlorine.	Bark of stem, cryptogamia detected by the microscope.
Guaiaci Resina (stem exudation, natural or prepared)	"	"	"	Large brownish masses marked with green; applied to a paring of raw potato it strikes a blue colour; precipitated from solution by sweet spirits of nitre, nothing floating. Scarcely soluble in turpentine, soluble in ammonia.	Resin odour when burned, soluble in turpentine, insoluble in ammonia. Experiment on tincture with sol. of potass.
Hæmatoxyli Lignum (sliced heart-wood)	Hæmatoxylum campechianum	Leguminosæ	Jamaica. Campeachy. Honduras.	Reddish-brown chips; feeble odour; sweetish taste; imparts dark pink colour to saliva, which acids brighten and alkalies darken. Logwood.	
Hemidesmi Radix (dried)	Hemidesmus indicus	Asclepiadaceæ	India	Yellowish-brown; fragrant; annular cracks; a cord-like centre surrounded by a cortical portion.	
Hordeum Decorticatum (husked seeds)	Hordeum distichon	Graminaceæ	Gt. Britain	White; rounded; trace of the longitudinal furrow. Pearl barley.	
Hyoscyami Folia (fresh leaves and branches, or dried leaves).	Hyoscyamus niger Henbane	Solanaceæ	"	From biennial plants, leaves sinuated; juice dilates the pupil. A. p. Hyoscyamine, white; sublimate netted.	
Indigo	Indigofera tinctoria.	Leguminosæ	India	Cubical blue cakes, copper-red when rubbed; powder deep-blue; insoluble in water, oils, and dilute acids.	
Ipecacuanha (dried roots)	Cephaëlis Ipecacuanha.	Cinchonaceæ	Brazil	Length a few inches; size of small quill; white tough inert centre, surrounded by a brittle annulated active envelope. Emetine a. p. soluble in spirit and water, insoluble in ether and fixed oils.	White, free from wrinkles, less active than the grey or brown striated.
Jalapa (dried tubercles)	Exogonium Purga	Convolvulaceæ	Mexico	Variable size, ovoid shape, hard, and covered with thin brown cuticle; ginger bread odour when powdered.	Jalap wood, pale, angular; *Jalap digits.*

Name, &c.	*Plant.*	*Natural Order.*	*Country.*	*Chief Characters.*	*Adulteration, or Substitution.*
Jalapæ Resina (impure jalapine)	Exogonium Purga	Convolvulaceæ		Dark brown, opaque, brittle fragments; acrid taste, gingerbread odour; soluble in spirit; insoluble in turpentine and benzine.	Guaiacum resin. Dissolve a grain in a few drops of spirit in a watch glass placed on white paper, touch with sol. of some copper salt (nitrate), and drop in a drop of dilute hydrocy. acid, a blue coloration takes place.
Juniperi Oleum (distilled from unripe fruit, *i.e.* galbulus)	Juniperus communis.	Coniferæ.	Europe	Colourless, or pale greenish-yellow. S. g. 0.885 isomeric with turpentine (alike in chemical properties, different in physical).	
Kamala (minute glands covering the capsule)	Rottlera tinctoria	Euphorbiaceæ	India	Mobile brick-red powder, not easily mixed with water. Ether desolves all but a residue of tufted hairs.	Sand; earthy impurities.
Kino (inspissated trunk-juice)	Pterocarpus Marsupium	Leguminosæ	Malabar	Fragments, small, angular, brittle, reddish-black, edges ruby-red; inodorous; astringent, tinging saliva blood-red. After long keeping its alcoholic solution gives a gelatinous deposit.	Dragon's blood; insoluble in water; ext. rhatany; reddens test-paper.
Krameriæ Radix (dried root)	Krameria triandra	Polygylaceæ	Peru	Diameter one inch; branches long, numerous, brownish-red, and rough externally; reddish-yellow internally; astringent, tinging the saliva red.	
Lactuca (flowering herb)	Lactuca virosa Lettuce	Compositæ	Gt. Britain.		
Laurocerasi Folia (fresh leaves)	Prunus Laurocerasus Cherry laurel	Rosaceæ	"	Smooth, shining, deep-green leaves, distantly serrulate; ratafia odour when bruised.	
Lavandulæ Oleum	Lavandula vera	Labiatæ	"	Colourless, or pale yellow; lavender odour; fulminates with iodine, by which it is distinguished from the oil of most labiate plants.	Spirit; dissolves santaline.
Limonis Cortex (fresh outer rind)	Citrus Limonum	Aurantiaceæ	S. Europe.	Yellowish, dotted with oil vesicles. Lemon peel. Oleum.	
Limonis Succus (freshly expressed juice)	"	"	"	Turbid greenish-yellow. S. g. 1.039, contains 7 per cent. of citric acid, both variable. Old juice often contains no citric acid.	Tartaric acid detected by acetate of potash.

Lini Semina	Linum usitatissimum	Linaceæ	Gt. Britain	Shining, brown, oval, flat; mucilage precipitated by neutral acetate of lead. Farina, powdered linseed cake free from pungency and oil (seeds merely crushed preferred). Oleum expressed from seeds.	Mustard cake.
Litmus (pigment)	Rocoella fuciformis (tinctoria)	Lichenes	E. Atlantic Islands. Madagascar. "Prepared in Holland."	Square cakes of an indigo blue colour. Reddened by acids, blue colour restored by alkalies.	Indigo vaporized by heat, giving off a well-known odour.
Lobelia (dried flowering herb)	Lobelia inflata	Lobeliaceæ	N. America.	In square parcels; leaves alternate, toothed; capsules ten-ribbed; dust irritating.	
Lupulus (dried strobiles of female plant)	Humulus Lupulus	Cannabinaceæ	Gt. Britain.	Strobiles greenish-yellow; aromatic, bitter; minute yellow grains adherent to base of the scales. Hops.	
Manna (concrete saccharine exudation)	Fraxinus Ornus	Oleaceæ	Sicily. Calabria.	Resemblance to compressed honeycomb, but no regular structure. Treated with boiling spirit yields 60 per cent. of mannite, which is soluble in six parts of water, also in sulphuric acid without change of colour.	Sugar with honey, &c., fermentable; mannite, unfermentable.
Mastiche (resinous stem exudation)	Pistacia Lentiscus	Anacardiaceæ	Scio	Small, yellowish, brittle tears; odour faint, agreeable. Soluble in ether and turpentine.	
Maticæ Folia (dried)	Artanthe elongata	Piperaceæ	Peru	Leaves several inches in length; tesselated above, downy beneath; leaf-stalk short. Aromatic.	
Menthæ Piperitæ Oleum	Mentha Piperita Peppermint	Labiatæ	Great Britain	Colourless or pale yellow; strong odour.	
Menthæ Viridis Oleum	Mentha viridis Spearmint	"	"	Colourless or pale yellow; strong odour.	
Mezerei Cortex (dried)	Daphne Mezereum D. Laureola Spurge Laurel, &c	Thymelaceæ	"	Tough flexible strips, or quills; outside olive brown, inside white; hot, acrid. Properties imparted to water, vinegar, oils, and spirit.	
Mica Panis				Crumb of bread.	
Mori Succus (juice of ripe fruit)	Morus nigra	Moraceæ	"	Mulberry juice; dark violet colour; sweet acidulous taste. Ft. a sorosis.	
Myristica (kernel of seed)	Myristica officinalis	Myristicaceæ	Banda Islands Malayan Archipelago	The common nutmeg, limed or unlimed. Oleum, two sorts, distilled and expressed.	Artificial, or without oil.

Name, &c.	*Plant.*	*Natural Order.*	*Country.*	*Chief Characters.*	*Adulteration, or Substitution.*
Myrrha (gum resinous stem-exudation)	Balsamodendron Myrrha	Amyridaceæ	Abyssinia Arabia Felix	Brownish-red tears or masses; fractured surface irregular and oily; odour aromatic; bitter, acrid; partly dissolved by water.	Bdellium, hard, fresh fracture terebinthinate. Myrrh 1, Sal-ammoniac 1, triturated for 15 minutes, should be soluble by trituration in 100. of water.
Nectandræ Cortex (Bebeeru bark)	Nectandra Rodiæi Greenheart tree	Lauraceæ	British Guiana	Flat heavy pieces a foot or more in length; two to six inches broad; a quarter of an inch thick. Outside greyish-brown, darker within; bitter; astringent.	
Nux Vomica (seed)	Strychnos Nux vomica	Loganiaceæ	India	Resembles the top of a small flat toadstool; greyish, covered with satiny hairs; inodorous; hard, bitter, a. p. Strychnine.	
Olivæ Oleum	Olea europæa	Oleaceæ	S. Europe	Pale yellow: solid when cooled with ice; partially congealed at 36°. S. g. .915.	Poppy oil, s. g. .929; not congealed by ice; seed oils, tests doubtful. Agitate with glyc. of tannin and water and compare. Odour when strongly heated.
Opium (inspissated juice)	Papaver somniferum	Papaveraceæ	Asia Minor	Chestnut-brown lumps, sometimes enveloped in poppy leaves and covered with the fruit of a species of rumex; peculiar odour and taste; several sorts. Yields 8 per cent. of morphia. Opium from P. Nig. (France), yields 20 per cent.	Water, metal, stones, sand; refuse of morphia or tincture processes; chopped leaves, &c.
Papaveris Capsulæ	"	"	Great Britain	Globular, crowned by sessile stigma; placentæ parietal.	
Pareiræ Radix ("often stem")	Cissampelos Pareira	Menispermaceæ	Brazil. West Indies	Pieces cylindrical; entire, or split; a few inches diameter; from a few inches to several feet in length; incomplete concentric rings, and rays. Greyish-brown bark, wrinkled lengthwise. Sweetish, aromatic; very bitter.	Stem; evident pith, rootlets, less bitter.
Physostigmatis Faba (seed)	Physostigma venenosum	Leguminosæ	W. Africa	Resembles the horse bean; sides flat; furrow at convex margin terminating in aperture at end. Calabar bean.	
Pimenta (dried unripe berries	Eugenia Pimenta	Myrtaceæ	W. Indies	Size of pea, brown, aromatic, containing two small seeds. Oleum sinks in water, s. g. 1.021.	

				White pepper consists of the soundest berries deprived of their covering.
Pix Burgundica (resinous exudation)	Abies excelsa	Coniferæ	Germany. Norway	Hard, brittle, mass slowly flattening, free from vesicles and bitterness; gives off no water when heated. Water agitated with it acquires a brown colour and sharp taste.
Pix Liquida (Tar)	Pinus sylvestris	"	"	Thick, viscid, brownish black; water agitated with it acquires a brown colour, acid reaction, &c.
Podophylli Radix (dried rhizome)	Podophyllum peltatum	Ranunculaceæ	N. America	Variable length; two lines diameter; externally reddish brown, whitish within; rootlets pale brown; bitter.
Podophylli Resina	"	"		Pale-green amorphous powder; soluble in spirit, ammonia, and nearly in ether; precipitated from a spirituous solution by water, from an ammoniacal by acids.
Prunum (dried drupe)	Prunus domestica	Rosaceæ	S. Europe	The prune.
Pterocarpi Lignum (billets)	Pterocarpus santalinus	Leguminosæ	Ceylon	Red sandal wood—Dense, variegated, brown billets. Powder blood-red; faint odour; astringent taste.
Pyrethri Radix	Anacyclus Pyrethrum Pellitory of Spain	Compositæ	Levant	Size of little finger; dark-brown bark; resinous fracture; radiated structure, hot prickling taste.
Quassiæ Lignum (billets and chips)	Picræna excelsa	Simarubaceæ	Jamaica	Wood, dense, tough, yellowish white; purely bitter. Infusion does not blacken with sulphate of iron.
Quercûs Cortex (from small branches and young stems)	Quercus pedunculata Oak	Cupuliferæ	Gt Britain	Epidermis grey; inner bark brown and fibrous; strongly astringent. Tannic acid 15 per cent.
Resina (residue of turpentine distillation)	Pinus et Abies	Coniferæ	(America)	Soluble in turpentine, ether, alcohol, and many volatile oils; consists of abietic acid, crystallizable, and pinic acid, amorphous.
Rhamni Succus (recently expressed juice of ripe berries)	Rhamnus catharticus Buckthorn	Rhamnaceæ	Gt. Britain	Berries somewhat resemble coffee berries, but paler and no furrow; black and shining, containing a greenish nauseous pulp.

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Rhei Radix (dried root deprived of bark)	Rheum palmatum Rhubarb	Polygonaceæ	China, E. Tartary, Thibet	Angular, or rounded pieces; bored, but free from decay; exterior not browned by boracic acid; internally marbled with waving greyish and reddish lines, no concentric markings (Eng.).	Inferior sorts coloured with turmeric, browned by boracic acid. Powder, in common with expensive powders, adulterated. Eng. Rhubarb, turmeric, flour.
Rhœados Petala (fresh petals)	Papaver Rhœas Red Poppy	Papaveraceæ	Gt. Britain	Scarlet colour; darker at base; poppy odour.	
Ricini Oleum (expressed from seeds)	Ricinus communis Castor oil plant	Euphorbiaceæ	Calcutta	Viscid, almost colourless; acrid; soluble in two volumes of spirit.	Fixed oils with croton oil; scarcely soluble in spirit.
Rosæ Caninæ Fructus (Cynarrhodum)	Rosa canina	Rosaceæ	Gt. Britain	Ovoid, scarlet, smooth, shining, subacid, sweet. Hips.	
Rosæ Centifoliæ Petala (fresh expanded)	R. centifolia.	,,	,,	Odour and taste imparted to water.	
Rosæ Gallicæ Petala (fresh and dried unexpanded)	R. gallica.	,,	,,	Purplish-red; odour retained after drying.	
Rosmarini Oleum (from the flg. tops)	Rosmarinus officinalis	Labiatæ	,,	Colourless; characteristic odour. S. g. 0.886.	
Rutæ Oleum (from fresh herb)	Ruta graveolens	Rutaceæ	,,	Pale yellow; acrid, bitter; odour unpleasant.	
Sabadilla (dried fruit)	Asagræa officinalis	Melanthaceæ	Mexico, Vera Cruz	Three light-brown papyraceous follicles, each containing from one to three acrid, bitter seeds. A. p. Veratria.	
Sabinæ Cacumina (fresh and dried tops)	Juniperus Sabina	Coniferæ	Gt. Britain	Twigs, covered with imbricated leaves in four rows; odour and taste strong and disagreeable. Oleum.	
Saccharum Purificatum (prepared from stem juice)	Saccharum Officinarum	Graminaceæ	W. Indies	Lump Sugar. Decomposed by sulphuric acid ($C_{12}H_{22}O_{11}$). Lead rarely occurs as an impurity.	Beet.
Sambuci Flores (fresh)	Sambucus nigra	Caprifoliaceæ	Gt. Britain	White, small, fragrant; cymes crowded.	
Santonica (unexpanded flower heads)	Artemisia	Compositæ	Russia	Flower heads not round or hairy. Imbricated scales, with green midrib enclosing four or five small tubular flowers, odour strong.	

				rootlets. Imported in bundles a foot or more in length.	
Sassafras Radix (dried)	Sassafras officinale	Lauraceæ	N. America.	Branched pieces covered with brown bark, or in chips. Wood of a light colour, pleasant odour, warm aromatic taste.	
Scammoniæ Radix (dried)	Convolvulus Scammonia.	Convolvulaceæ	Syria. Asia Minor.	Tap shaped; top 3 inches diameter; brown without, white within; slight odour; yields its resin to ether.	
Scammoniæ Resina (from root, or scammonium)	”	”		Brownish; brittle; does not form an emulsion with water; soluble in ether and chloroform, insoluble in turpentine; tincture does not turn a potato paring blue.	Jalap resin partially soluble in ether. Resin, soluble in turpentine. Guaiacum resin, try hypochlorite of soda to a tincture. (*See* Jalap.)
Scammonium (gum resin from root)	”	”	”	Ash grey; forms an emulsion with water; ether dissolves 80 per cent. resin; no effervescence on addition of acids.	Chalk, starch, magnesia.
Scilla (sliced and dried bulb)	Urginea Scilla Squill	Liliaceæ	Mediterranean	Bulb from ½ a pound to 10 pounds; outer scales membranous, brownish red, or white; inner scales whitish, fleshy; brittle when dry, quickly absorbing moisture; bitter; inodorous.	
Scoparii Cacumina (fresh and dried tops)	Sarothamnus Scoparius Broom.	Leguminosæ	Gt. Britain.	Angular, tough, dark-green twigs; nauseous bitter taste; odour when bruised.	
Senegæ Radix (dried)	Polygala Senega	Polygalaceæ	N. America	Rhizome knobby; tap root branched, thickness of quill, twisted, keeled; bark yellowish brown, sweet, pungent, active; interior woody, inert.	
Senna Alexandrina (dried leaflets)	Cassia lanceolata Cassia obovata	Leguminosæ	Alexandria	One inch in length; lanceolate or obovate; base unequally oblique; free from bitterness.	Argel leaves pale, equal sided, bitter. Tephrosia leaves, equal sided, silvery.
Senna Indica (dried leaflets)	Cassia elongata	”	S. India.	Two inches in length; lanceolate acute; flexible; base, odour and taste like Alexandrian, unadulterated.	
Serpentariæ Radix (rhizome and rootlets)	Aristolochia Serpentaria	Aristolochiaceæ	N. America	Rhizome roundish with tuft of slender rootlets; camphoraceous odour & taste.	
Sinapis (whole and powdered seeds)	Sinapis nig. et alba. Mustard	Cruciferæ	Gt. Britain	Powder should be yellow, pungent, and free from starch, &c. Oleum; dist. from the black mustard. Oleum expressum.	Starch, mustard cake flour.
Stramonii Folia (dried)	Datura Stramonium. Thorn apple.	Solanaceæ		Deeply cut; mawkish, bitter.	

Name, &c.	*Plant.*	*Natural Order.*	*Country.*	*Chief Characters.*	*Adulteration, or Substitution.*
Stramonii Semina	Datura Stramonium. Thorn apple	Solanaceæ		Brownish black; reniform; flat; rough; bitter; inodorous, unless bruised.	
Styrax Præparatus (balsam from bark, purified)	Liquidamber orientale	Liquidambaraceæ	Asia Minor	Semi-transparent; consistence of honey; becomes liquid when heated by a water bath, but gives off no moisture; fragrant. Distilled with a weak solution of carbonate of soda a volatile oil comes over containing cinnamene or styrolene (C_8H_8).	
Sumbul Radix (dried transverse slices)	Euryangium Sumbul	Umbelliferæ	India	Diameter a few inches; a somewhat osseous appearance; light; covered with a soft bast bark; musk odour. The Russian is less dense and red.	
Tabaci Folia (dried, not manufactured)	Nicotiana Tabacum	Solanaceæ	America	Mottled; brown; ovate or lanceolate acuminate; peculiar odour and taste. A.p. nicotine differing from other vegetable bases except those of hemlock and broom, in being a volatile oily liquid.	
Tamarindus (preserved fruit-pulp)	Tamarindus indica	Leguminosæ	W. Indies	Pulp brown; containing strong fibres and brown shining seeds with membranous coats; sweetish subacid taste.	Copper, from vessels used in preparing it. Displaced by iron.
Taraxaci Radix (fresh and dried)	Taraxacum Dens Leonis Dandelion	Compositæ	Gt. Britain	Smooth, dark brown, or yellowish; tap-shaped; not wrinkled, or pale. Juice milky, bitter.	
Terebinthina Canadensis (stem oleo-resin)	Abies balsamea	Coniferæ	Canada	Honey consistence; clear pale yellow; odour agreeable; solidified by a sixth part of magnesia. Canada balsam.	
Theobromæ Oleum (concrete seed-oil)	Theobroma Cacao	Byttneriaceæ	W. Indies Mexico	Consistence of tallow; yellow; chocolate odour; cool bland taste; not rancid by exposure. Melts at 122° Beurre de Cacao, Cacao butter, is also met with in small hard blocks.	
Terebinthinæ Oleum (distilled from the oleo-resin)	Pinus Pinaster Pinus Tæda P. maritima	Coniferæ	France America	Limpid, colourless; strong odour; bitter. Varieties: insoluble in water; slightly soluble in weak spirit; miscible with alcohol, ether, and bisulphide of carbon, they dissolve sulphur, iodine and phosphorus, s. g. .864 (Turpentine).	

nning)				cle.	
Thus Americanum (concrete turpentine)	Pinus Palustris Pinus Tæda	Coniferæ	N. America	Bright yellow, opaque, tough, solid; odour of turpentine. Common Frankincense.	
Tragacantha (stem exudation)	Astragalus verus	Leguminosæ	Asia Minor	Horny shell-like plates; almost insoluble in water. The gelatinous mass is coloured blue by iodine. Bassorin is the gum principle; scarcely soluble in water; not precipitated by alcohol.	Gums whitened with lead.
Turmeric (rhizome)	Curcuma longa	Zingiberaceæ	India	Round or long; the latter curved, pointed; annular wrinkles; externally yellowish; internally reddish-brown; length, a few inches.	
Ulmi Cortex (dried inner bark)	Ulmus campestris Elm	Ulmaceæ	Gt. Britain	Tough; brownish-yellow; decoction turned green by perchloride of iron, and precipitates with solution of gelatine.	
Uvæ Ursi Folia (dried)	Arctostaphylos Uva Ursi Bearberry	Ericaceæ		Obovate; entire; coriaceous; shiny; reticulated beneath; not dotted or toothed. Infusion with perchloride of iron, gives a bluish-black precipitate.	
Uvæ (dried ripe fruit)	Vitis vinifera	Vitaceæ	Spain	Raisins. Ft. a nuculanium.	
Valerianæ Radix (dried)	Valeriana officinalis	Valerianaceæ	Gt. Britain	Resembles serpentary, but thicker; odour disagreeable and characteristic.	
Veratri Viridis Radix (dried rhizome)	Veratrum viride	Melanthaceæ	U. States, Canada	Stumps cut longitudinally, crowned by the sheathing induviæ, yellow adventitious roots below.	Compare V. alb. V. nig.
Zingiber (dried scraped rhizome)	Zingiber officinale	Zingiberaceæ	W. Indies, India	Irregularly lobed; yellowish-white; not chalky; short fibrous fracture; hot agreeable taste. Ginger.	

ANIMAL SUBSTANCES.

Name, &c.	*Animal.*	*Class Order.*	*Country.*	*Chief Characters.*	*Adulteration, or Substitution.*
Adeps Præparatus (purified internal fat)	Sus scrofa the Hog	Mammalia. Pachydermata		Soft, white, melting at 100°; not rancid; soluble in ether; free from starch and salt.	Salt, starch, detected by their respective tests.
Adeps Benzoatus (benzoated lard)	”	”		Prepared lard, impregnated with benzoin, one part benzoin in forty-three of lard. See prep.	
Cantharis (dried insect)	Cantharis vesicatoria Beetle	Insecta. Coleoptera	Hungary Russia S. Europe	Eight lines long; two shining green wing covers, under which are two membranous wings; odour strong. Free from mites. Should yield one-half per cent. cantharidine.	Euphorbium is found with the powder, it deposits from a cooled filtered alcoholic solution.
Castoreum (dried preputial follicles, with their secretion)	Castor fiber the Beaver	Mammalia. Rodentia.	Hudson's Bay territories	Follicles in pairs; three inches in length; fig-shaped; firm; heavy; brown, or greyish black; brown highly odorous resinous secretion, nearly dissolved by ether or spirit. Russian, a white precipitate; Canadian, an orange precipitate; with weak solution of ammonia.	Small oil sacs from the same animal are sometimes attached.
Cera Alba (wax bleached by exposure to moisture, air, and light, or by chemicals, weak chromic acid, &c.)	Apis mellifica Hive Bee	Insecta. Hymenoptera	Gt. Britain	Hard, nearly white, translucent; neither unctous nor quite smooth to the touch; does not melt under 150°. Dissolved in chloroform, a layer floating.	Spermaceti 60 per cent. Stearin.
Cera Flava Wax (prepared honeycomb)	”	”	”	Yellowish; granular fracture; yields nothing to cold spirit; soluble in turpentine; contains myricin insoluble, and cerin soluble, in boiling alcohol. Does not melt under 140°.	Suet. Resin, soluble in cold alcohol. Meal, insoluble in turpentine. Starch, iodine test. Vegetable wax is dissolved by chloroform, nothing floating.
Mel Honey (saccharine secretion)	”	”	”	Liquid when new; solid when old; boiled with water five minutes and allowed to cool, the decoction does not become blue on addition of iodine. Mel Depuratum, see clarified honey.	Flour, insoluble in cold water, turned blue by iodine.

pressure)				slightly soluble in boiling alcohol.	ether, and less lamellar or shining.
Coccus (dried female insect)	Coccus Cacti Cochineal Insect	Insecta. Hemiptera	Mexico Teneriffe	Ovate, plano-convex; two lines long; wrinkled; black, or greyish white becoming black when warmed; colouring principle carmine, soluble in alcohol and water, turned yellow by chlorine and iodine.	Salts of baryta to give weight, or of lead to give colour; the latter easily detected by a lens from the wool-like powder of the grey insect.
Hirudo (the Leech)	I. Sanguisuga medicinalis II. Sanguisuga officinalis (1. English Leech) (2. Green Leech)	Annulosa	S. Europe.	Elongated, plano-convex; back olive green, with six longitudinal stripes: 1. Belly greenish yellow with black spots. 2. Belly olive green, not spotted.	
Icthyocolla (Isinglass) (prepared sounds or shreds)	Acipenser (sp. var.)	Pisces	Black and Caspian Seas	It precipitates tannic acid, but not gallic. It contains 98 per cent. of gelatine.	Brazilian. E. Indian.
Lac (fresh milk)	Bos taurus (spec.)	Mammalia. Ruminantia		Water, 862.8; butter, 43.8; sugar, 52.7; casein, 38.0; salts, 2.7: s. g. 1.030 to 1.032; skimmed, 1.037.	Water, often impure, flour, starch. Evaporate in water bath, calculate water, exhaust with ether, calculate fat, wash freely with water, and calculate sugar.
Lactis Saccharum (from whey)	,,	,,		In masses a few inches diameter; greyish white, surface crystalline, translucent; hard, scentless, faintly sweet, gritty between the teeth; soluble in six parts of water. $C_{12}H_{24}O_{12}$, or $C_{12}(OH_2)_{12}$.	
Moschus (dried secretion from the preputial follicles)	Moschus moschiferus Musk Animal	,,	Thibet. C. Asia	Irregular, reddish black, unctuous grains; strong peculiar odour; bitter; contained in a roundish membranous sac, 2 inches diameter, covered with stiff hairs arranged in a concentric manner around the orifice; infusion precipitated by tincture of galls, acetate of lead, but not by perchloride of mercury. 0.6 soluble in boiling water.	Russian more nauseous, less powerful. Artificial sacs, absence of aperture, hairs not arranged in a circular manner; dried blood (microscope).

Name, &c.	*Animal.*	*Class Order.*	*Country.*	*Chief Characters.*	*Adulteration, or Substitution.*
Oleum Morrhuæ (extracted from fresh livers at a heat less than 180°)	Gadus Morrhua	Pisces	Newfoundland European coasts	Pale yellow, s. g. .915 to .939; dissolves the alkaloid quinia; soluble in ether; slightly in alcohol; violet colour on addition of strong sulphuric acid.	
Ovi Albumen (liquid white of egg)	Gallus Banckiva var. domesticus	Aves		Precipitated when agitated with ether; coagulated by creosote and turpentine; insoluble in nitric acid; boiled with acetate of lead and caustic potash sulphide of lead is formed.	
Ovi Vitellus (yolk of egg)	"	"			
Sevum Præparatum (purified internal abdominal fat)	Ovis aries Sheep	Mammalia. Ruminantia		White, smooth; fusible at 103°. Stearic acid may be obtained by saponifying the fat with soda ley, heating the soap with dilute sulphuric acid and water, and dissolving the separated fat in hot alcohol; oleic acid remains in solution, stearic acid separates on cooling.	

DESCRIPTIVE BOTANY.

General terms arise from considerations of distinction and definition of parts, modifications, presence or absence, structure and function, appendages, cohesion and adhesion, insertion or emergence, connectors or stalks, points of connection, form and shape, number, actual and relative time changes, order of appearance, and conditions.

Particular terms arise more from considerations of size, habit, *i.e.* appearance and habit proper, relations of plants and their parts in structure and position, presence or absence, cohesion or separation of the protective and essential floral whorls and their appendages; again, names of representative individuals from constant minor characters associated with foregoing.

ROOT.

Root, radix.—Either a descending axis or adventitious.

Shape, Form, Condition.—Cylindrical, fusiform, conical, napiform, contorted, solitary, fleshy, abrupt, præmorse, flattened, coralline, moniliform, annulated, nodose or torulose, tuberculated, fasciculated or clustered, fibrous, cœspitose or tufted, flexuose, ærial. Spongioles, root suckers, properly fibrils. Radicle, embryo-root.

Mode of Growth.—Exorhizal, radicle elongating; endorhizal, radicle branching, each branch covered at base where it pierces the integument with a coleorhiza or sheath; heterorhizal, root-making of spores, roots proceeding indifferently from any part.

STEM.

Stem, caulis.—Ascending axis, trunk, bole. *Modifications:* sarmentum, annual woody twining; rachis, stem of ferns, also main axis of compound leaf; culm, caudex, stipe, stems of grasses; scape, a naked flower-stalk, either simple as in the primrose, or compound as in the cowslip, *i.e.* branched or unbranched. Gemmule or plumule, embryo-stem.

Branches.—*Ærial* spine, cirrhus or tendril. *Subterranean:* soboles or creeping root; tuber; corm, solid enlarged base of a monocotyledonous plant; bulb, like corm but tunicated or scaly. *Sub-ærial:* Rhizome or root-stock; flagellum, runner, elongated prostrate given off from base of stem; sucker, subterranean becoming ærial; turio, a scaly sucker; stolon, ærial becoming subterranean; offset, a thickened runner. The above are distinguished from roots by the presence of buds, scales, or leaves; they are either circumstantial modifications of branches, or especial adaptations for propagation, giving off as they do leaves from their upper surfaces or extremities, and roots from their lower ones. *Modifications:* buds or phytons, bulbils.

Relative Positions.— Erect, patent, excurrent (firs), diffused, widely spreading; procumbent, prostrate, or humifuse; decumbent, prostrate growing part rising; volubile, twining; scandent or climbing by crampons; homodromous, running in one direction.

Shape, Form.—Terete, transverse section round; cylindrical; quadrate; prismatic, transverse section deltoid or pyramidal, or, if angles end in wings, triquetrous; angular; polygonal; flexuose or zigzag.

Appendages. — Verrucæ, papillæ, squamæ, scales or lepides, thorns, prickles, setæ, hairs, glands, perulæ or tegmenta, protective scales of buds, cicatrices, scars of articulated leaves, induviæ, remains of withered leaves, ochreæ, membranous stipular appendages surrounding nodes or knots. Stipules, petiolar appendages.

Condition.—Caulescent, acaulescent, herbaceous, fructicose or shrubby, viscous, glabrous, echinate, asperous, muricate or covered with short hard points, pubescent, hairy, villous, floccose; hairs may be simple, or one-celled, compound, or many-celled, straight, glochidiate, uncinate, stellate. These conditions, of course, apply also to leaves, fruit, &c.: dichotomous, dividing by twos; trichotomous, dividing by threes.

LEAF.

Leaf, folium, phyllum.—Soft parts of stem expanded laterally, and mostly intersected by fibro-vascular bundles; frond, leaf of ferns; leaflets, divisions of a compound leaf. Petiole, leaf stalk; lamina, blade.

Modifications.—*Petiolar:* reticulum, *see* Palms; pericladium, *see* Umbelliferæ; ligule, *see* Grasses; phyllodium, a blade-like leaf-stalk, its margins often vertical; ascidium, a pitcher-shaped phyllodium. *Laminar:* pinnæ, pinnules, scales, phyllaries, *see* Compositæ, sepals, petals, bracts; bracteolar modifications are—bracteoles, epicalyx, phyllaries, involucres, involucels, glumes, glumellæ, paleæ, lodiculæ, spathe, scales. All parts which arise after the leaves—such as the floral envelopes and flowers, ovary, and fruit—may be regarded as modifications of leaf, and the growths therefrom as transformed buds. Pulvinus, thickened base of petiole. Ampulla, a hollow leaf.

Adhesion—adnate or marginal; connate or basal; perfoliate, a strongly marked form of connate; decurrent, adherent to stem by blade.

Circumscription.—*Marginal:* entire, lobed, fissured, arcuate, crenate lobes rounded, crenulate, serrate, serrulate, dentate, denticulate, fringed; *subapical:* truncate, retuse, emarginate, notched; *apical:* apiculate, mucronate, cuspidate, acute, attenuate, acuminate. When apex of leaf or leaflet terminates abruptly the mid-rib is often found to project as a small point: this is called *mucro*, if hard; *apiculus*, if soft; hence the terms.

Division.—Simple, more or less entire, or not divided by a narrow base from mid-rib; cleft (fid), divided half way, parted (partite), divided more than half way; compound, divided to mid-rib, and attached by narrow base or stalk. These terms are applied to calyx and corolla.

Shape.—Simple leaves: orbicular, rotundate, ovate or egg-shape, cordate, oval or elliptical, parabolic, oval with truncate or abrupt base, lanceolate, linear, having margins parallel, reniform, hastate, sagittate, ensiform, dolabriform, axe shape, gibbous, hunched or swollen, lyrate, panduriform, fiddle shape, runcinate, pinnatifid with triangular termination and sharp lateral divisions pointing downwards (dandelion). The terms pinnate and palmate, also pedate, are used mostly as prefixes to simple leaves, as pinnately veined, pinnatifid, pinnatipartite, pinnatisected, &c. *Compound leaves:* terms of simple leaves for outline, pedate. Two types—*pinnate:* number of pairs of leaflets indicated by jugate prefixed by uni, bi, tri, quadri, quinque, sex, septem, multi; number of times pinnate by bi, tri; beyond this, decompound; should there be a terminal leaflet the leaf is imparipinnate; or, if ending in a pair, paripinnate;—*palmate:* number of leaflets expressed by above numerals prefixed to foliate or analogous ones to nate, as ternate, septenate, multifoliate. Bifoliate and trifoliate leaves may often be regarded as pinnate leaves, having only the first series of leaflets, so the terms biternate or triternate, although in use, may be discarded for ternatopinnate, &c. A leaf may exhibit both types or a mixed arrangement—thus, palmipinnate; again, smaller leaves may alternate with larger ones when the leaf is interruptedly pinnate or palmate. Ob, prefix, inversely.

Condition.—Foliaceous, stipulaceous, fulcraceous, constricted, carnose, scarious, coriaceous, crustaceous, cirrhose; see also conditions of stem.

Position.—Radical, cauline, ramal, floral or bracts, primordial or next after cotyledonary; alternate or scattered; bifarious or oppposite; distichous exactly alternate; tristichous, three ranked, third leaf being over first, &c. (angular divergence 360° × number of whorls ÷ leaves passed over); unilateral; decussate, pairs of opp. leaves at right angles to one another; divaricate; connivent or converging; furcate; valvate, margins adpressed; imbricate margins overlapping; synochreate, margins on one side uniting; verticillate; equitant, a conduplicate leaf enclosing its successor; conduplicate, margins of upper pagina folded together; reduplicate, margins of lower pagina folded together; reclinate or inflexed, apex of upper pagina folded on or towards base; reflexed apex of lower pagina folded towards base: rolled forms are—circinate, apex to base; convolute, simply rolled, one margin being free; involute, margins rolled on upper pagina towards mid-rib; revolute, margins rolled on lower pagina towards mid-rib. Many of these terms are loosely applied, *e.g.* inflexed means frequently rolled, curled, or folded towards base; other terms are—lateral, adventitious, or accessory, axillary (extra, infra, supra).

The first terms relate especially to phyllotaxy, or leaf arrangement; the others to vernation or præfoliation.

INFLORESCENCE OR ANTHOTAXIS.

Considerations of order of development have established two sorts of inflorescence; each is further qualified by results arising therefrom. Forms of floral collections are not constantly associated with these divisions; hence the terms embodying definitions of one are used as qualifying terms in the other. These divisions are—centripetal or indefinite; centrifugal, definite or cymose. The principal characters considered in the following table are length and division of the floral axes, presence or absence of pedicels:—

Indefinite (*Spical*).

[*]Axis	elongated,	Florets	sessile.	Perfect,[†] axis undiv.	Spike.
"	"	"	stalked.	Axis undiv., ped. equal in length	Raceme.
"	"	"	"	Racemose, axis divided	Panicle.
"	"	"	"	Racemose, axis div., fl. clustered	Thyrsus.
"	"	"	"	Racemose, base ped. longer than apical, forming nearly level top	Corymb.
"	dilated	"	sessile	Involucre, fl. crowded on receptacle	Anthodium or Capitulum.
"	"	"	"	Invol. absent, fl. on incurv. fleshy recep.	Hypanthodium.
"	"	"	stalked.	Anthodic, axes equal in length	Umbel.

Definite (*Cymose*).

Corymbose, or true cyme; helicoid or scorpoid, fl. developed on one side, axis circinate; fasicled or contracted, fl. crowded, pedic. equal in length. Other adjective terms are spiked, racemose, panicled, and umbellate. Glomerule, fl. sessile in rounded head or spike. Verticillaster, fl. sessile arranged in axils of opp. leaves in two clusters or verticillasters, central open first: fl. often subsessile.

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[*] Peduncle, flower stalk; pedicel, floret stalk.

[†] Modifications of spike: Amentum, fl. unisexual (either male or female only), bracts squamous. Spadix, axis succulent, no bractlets, spathe present or absent. Locusta, fl. few (grasses). Cone, fl. female, scales woody. Strobilus, fl. female, bracts membranous. The scorpoid cyme (books) is often a unilateral raceme. A plant may exhibit a mixed order of inflorescence, the flowers following one method, the florets another method (*see* Compositæ and Labiatæ).

FLOWER.

Flower, floret, flos.—Perfect or hermaphrodite may be achlamydeous or monochlamydeous (apetalous). Complete is hermaphrodite and dichlamydeous, *i.e.* sexual organs, stamens and pistil, protective appendages, calyx and corolla; incomplete may be achlamydeous, monochlamydeous, dichlamydeous, neuter, imperfect, perfect, unisexual or diclinous (see declinate). More accurate terms for unisexual are staminate and pistillate; and for plants on which they occur, monœcious, sexes on one individual, diœcious, sexes on two individuals, polygamous, hermaphrodite staminate and pistillate flowers on one plant. Phanerogamous, flowering; agamus or cryptogamous, no evident flowers. Regular, whorl divisions of same size; isomerous, whorl divisions of exactly the same number; symmetrical, whorl divisions of the same number or multiples of that number, type or multiple being expressed by binary, ternary, dimerous, trimerous.

Duration, &c.—Caducous, falling off at opening of flower; deciduous,* falling off after fertilization; a persistent whorl may be accrescent, growing during maturation of fruit, sometimes forming a loose covering to fruit, or marcrescent, growing into a firm part of fruit. Perianth, a single protective whorl, or a petaloid double one. Posterior, part turned towards axis or superior; anterior, part turned towards bract or inferior.

CALYX AND COROLLA.

Calyx, outer protective cup or whorl, often foliaceous, superior or inferior means adhesion or non-adhesion to ovary. United portion tube, free or upper portion limb; divisions of calyx are sepals, number indicated by the prefixes di, tri, tetra, penta, hexa, &c., and sepalous, parts of a monophyllous or gamosepalous calyx, by the same prefixes with toothed, cleft, parted. Form, *see* Corolla. Condition, *see* Leaf.

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* Deciduous means annual when applied to leaves.

Corolla, inner protective cup or whorl, mostly coloured; divisions are petals; terms denoting division, number, &c., as for calyx (petalous).

Form.—Monopetalous (reg. and irreg.): ligulate or strap-shaped, rotate, tubular or cylindrical, infundibuliform, campanulate, hypocrateriform or salver-shaped, tube long limb at right angles (*see* Primrose); labiate, ringent a wide form of labiate, personate a closed form of labiate. *Polypetalous* (reg. and irreg.): rosaceous, cruciform, liliaceous, caryophyllaceous, papilionaceous (*see* Systematic Botany.)

STAMENS.

Stamens, forming the male system, or andrœcium, each consists of non-essential filament or stalk, surmounted by pollen cells or anthers.

Number.—Relative: meiostemonous, fewer than divisions of corolla; isostemonous, stamens and floral envelopes with same number of parts or multiples; anisostemonous (*a* privative). *Actual number and adhesion:* free stamens to ten, indicated by the usual numeral prefixed to androus; dodecandrous, 11—20; polyandrous, 20—100 thalamic; icosandrous, 20—100 calycine. But when tetrandous flowers have two short and two long, they are didynamous; or tetradynamous if hexandrous, with two short and four long. Filamentary cohesion may be monadelphous, diadelphous, polyadelphous (number of bundles). Coherent anthers are syngenesious; stamens and pistil coherent, gynandrous.

Position—as regards corolla, included, not projecting beyond; exserted or protruded; declinate, exserted and curved towards one side. *As regards ovary*, hypogynous, perigynous, epigynous, below, around, above; these conditions and terms are applicable likewise to corolla. Thalamifloral agrees with hypogynous, calycifloral with perigynous and epigynous; but epipetalous must be considered a form of perigynous insertion. Terms more restricted in Systematic Botany.

Anther—emergence, dehiscence, &c.—innate, attached as lamina to petiole, filament being inserted; adnate, attached by full length; versatile, swinging on filiform filament. At the anthesis or opening of the flower, the anthers may present their sutures to or from the pistil, that is, they are either introrse or extrorse. Dehiscence may be longitudinal, transverse, porous, opercular, valvular. *Caution*—Examine the unopened flower for introrse, &c.

PISTIL.

Pistil, forming the female system or gynœcium, occupies the centre of the floral whorls, and consists of an ovary or hollow basal part, and a glandular pollen receptacle or stigma, a non-essential stalk called style mostly present, composed of one or more carpellary leaves, syncarpous when united together, apocarpous when free. Apocarpous may be simple (single) or multiple (arrangement either concentric or spiral). Style, erect, basal, lateral; gynobasic, several basal styles united into central column. Stigma, linear, hooded, penicillate, petaloid, apical, lateral (when lateral, stigmatic portion ventral).

Ovules.—Contents of ovary, rudimentary seeds; attached by funiculus or podosperm; placenta, the point of attachment, becomes evident in the seed as the hilum.

Growth: A nucleus on podosperm, from chalaza or base of which are mostly developed two coats—first, integumentum internum or secundine, then, integumentum externum or primine, which, enclosing ovule, leave mostly a foramen (micropyle of seed); the outer part of foramen is exostome, the inner endostome.

Position : *As regards ovary*, erect, ascending, horizontal, pendulous, suspended; *as regards parts*, either straight or curved; orthotropous or atropous, hilum and chalaza next placenta, micropyle opposite, organic and geometrical apices corresponding; anatropous or inverted, chalaza pushed up by funiculus micropyle near hilum, from which extends to chalaza a raphe or ridge. Should the chalaza remain in place, the ovule is campylotropous, or curved on self (no raphe); heterotropous, an intermediate form of inversion; amphitropous, an intermediate curving.

Number.—The suffix gynous with the numeral prefixes di, tri, &c., is used.

FRUIT.

Fruit, fructus.—Fecundated ovary or ovaries arrived at maturity, often accompanied by remains or altered structure of calyx and style or even stigma, composed of pericarp and seed.

Pericarp.—Often three distinct layers, epicarp, mesocarp (sarcocarp, if fleshy), endocarp. *Dehiscence*: method of opening when ripe, easily understood after the examination of a monocarpellary fruit, *e.g.* bean pod, a rough outer surface corresponding to under surface of leaf, an elevated dorsal suture or mid-rib, and a somewhat flattened ventral suture, corresponding to incurved margins, and, on opening it, to these doubled margins we find the seeds attached; then, with a syncarpous fruit, longitudinal dehiscence may be loculicidal, or by dorsal sutures, septicidal, or by ventral sutures. But should the valves or pieces separate from the developments of the incurved margins, leaving them attached in centre, the dehiscence is septifragal. Other forms of dehiscence are circumscissile or transverse, which sometimes take place in a more or less definite manner, so that the terms pyxidium, snuff-box, &c., are applied to the fruit. Placentaries; free central, parietal, or mixed as axial.

Seed.—Appendages: arillus, growth from funiculus; arillode, growth from micropyle; strophioles, growths from raphe. *Coverings:* testa or outer coat, marked by hilum and micropyle; tegmen or endopleura, inner coat, often indistinguishable. *Contents:* perisperm endosperm albumen, absent or present, mealy, farinaceous, oily, albuminous, exalbuminous; embryo, either in the albumen or external; internal, either axial, else abaxial or excentric; external, either lateral or peripherical (curved round). Parts of embryo; radicle, turned towards micropyle, plumule, and cotyledons, mono, di, poly.

Fruits formed by a single flower.

Single carpel, monogynœcial, one cell, superior—

One produced—	**indehis.**	**Pts. of per. separ. sarc. fleshy, end. hard, 1—2 s.**	**Drupe.**
	”	**Per. memb. loose, sometimes dehis. transv., &c.**	**Utricle.**
	dehis	**Dehis. by v. or d. sutures, 1 or more s. on vent.**	**Legume.**
	”	**Dehis. or indehis. dissep. spurious (Moniliform legume)**	**Lomentum.**
Several produced—	**indehis.**	**Per. dry, separ., closely applied, 1 s.**	**Achænium.**
	”	**Achænia. situated in hollow thalamus**	**Cynarrhodum.**
	”	**Achænia. (sometimes tiny drupes) in whorls on dry or fleshy thalamus**	**Etærio.**
	dehis	**Leguminous, dehis. by vent. suture only**	**Follicle.**

Two or more carpels combined—

Superior..	**dry indehis.**	**Achænic char. per. inseparable**	**Caryopsis.**
”	**”**	**Per. winged, cells two or more, s. few**	**Samara.**
”	**”**	**Coh. by united sty. to cent. ax., cells many, s. few**	**Carcerule.**
”	**”**	**Ext. woody, int. pulpy**	**Amphisarca.**

Superior..	fleshy indehis.	Baccate (mostly called berries), *see* Bacca	Nuculanium.
	" "	Drupaceous, s. deeply lobed by spur. dissep.	Tryma.
	" "	End. proj. int. dividing pulp into sep. parts, s. attached to inner angle	Hesperidium.
	dry dehis.	Cells one or more, dehis. valv. por. or trans.	Capsule.
	" "	Long nar., cells one to two, dehis. upwards by two valves	Siliqua.
	" "	Short siliqua (compare legume)	Silicula.
Inferior..	dry indehis.	Achænic	Cypsela.
	" "	Diachænium, two mericarps united to carpophore by commissures	Cremocarp.
	" "	Per. layers, indisting., hard, cell one, s. 1—2. (Nut)	Glans.
	fleshy "	Cells, one or more, s. many loose, plac. par. producing pulp	Bacca.
	" "	Baccate, cells three spur, s. never loose	Pepo.
	" "	End. cartilag., s. few, surrounded by fleshy mass	Pome.
	" "	Tough rind, two rows of carpels superimposed	Balausta.
	dry dehis.	Capsular	Diplotegia.

Fruits formed by the combination of several flowers.

	Etæric, fruit coher. with thalamus into fleshy mass	Sorosis.
	Cynarrhodic, formed of enlarged succulent recep.	Syconus.
See inflores.	Elong. s. enclosed in ovary at base of memb. scales	Strobilus.
	Elong. s. naked, scales indurated	Cone.
	Rounded, scales united into fleshy mass covering seeds	Galbulus.

NOTES ON STRUCTURAL BOTANY.

Repeated examinations of structure of root, stem, leaves, and their modifications, will show us that they are compound organs, or definite collections of more elementary organs which perform vital functions, and which by gradations may be traced to their origin, "*the cell.*"

The cell may be studied then for all common characters of structure and as illustrating inborn influences of growth, whilst the structures themselves will best exhibit modifying influences of cohesion, nutrition, and pressure, which bear upon cell development.

CELL.—A closed sac of membrane with fluid or semifluid contents: *form*, variable modifications approaching three tolerably distinct types, spheroidal, cylindrical, tabular; *cell-wall*, or membrane, composed of cellulose, colourless, elastic and flexible, homogeneous, permeable but not visibly porous; *size*, variable, spheroidal often $\frac{1}{200}$ inch, cylindrical, often inches; *cell modified by deposits*;—*lamellar* from irregularity, producing apparent pits and pores in cell-wall; these in old cells may be real. A form of pit is called disk, two cells with corresponding disks will exhibit a lenticular cavity, as in "Coniferæ"—*fibrous*, single, double, &c., annular, spiral, reticulated or scalariform, clathrate or latticed; protective cells have a modified cell-wall or pellicular coating resisting atmospheric action (*see* epidermal); *formation*, FREE, nucleus of protoplasm with defined border becoming vesicular, secretes on its outside a membrane of cellulose, the protoplasm not always evident as a nucleus; FISSIPAROUS DIVISION, hour-glass contraction of primordial utricle, each division secreting a coating of membrane; sometimes the cell divides into four others which become free from absorption of the walls of the parent cells; *contents—protoplasm*, tough, mucilaginous, more or less granular, colourless, *primordial* utricle, outer film of protoplasm applied to cell-wall, but separable therefrom by the action of some reagents; *nucleus*, rounded body identical in character to protoplasm; *chlorophyll*, green colouring matter of plants; *starch granules* occur in all plants except the fungi, often occupying greater part of cell in those tissues excluded from light, insoluble, but converted by germination or reagents into soluble dextrin and glucose; *cell-sap*, containing mineral salts; *raphides*, crystals of salts (lime), found in cells; *cystolithes*, suspended crystals.

Tissues, collections of cells, simple when component cells are of uniform character, compound if otherwise. Parenchyma, cells rounded or elliptical, sometimes woody from deposits; merenchyma, lax parenchyma; prosenchyma, cells elongated, attenuated, lateral surfaces united, ends insinuated between others above and below.

Parenchyma. Imperfect, three forms: rounded, tolerably uniform; lobed, or connected at few points; stellate, interspaces large, parts of cell coherent. *Perfect*, cells bounded and united together by plane surfaces may be, as regards size of component cells, regular or irregular; modifications of regular are prismatic (six-sided ends pyramidal), muriform, square or oblong with long diameter horizontal, tabular, as in the epidermal, where they are flattened above downwards.

Collenchyma, having horny deposits; *Sclerogen*, having bony deposits.

Prosenchyma, two forms: *woody fibre*, cells fusiform, length moderate; *liber*, cells slender, much elongated, often branched.

Vascular Tissue.—Rows of vertical cells fused, often much elongated, may, like their component cells, be spiral, annular, &c.; some forms with thin walled cells are called vasa propria.

ROOT STRUCTURE.—Fibro-vascular axis enveloped in cortical parenchyma, covered when young by epiblema (epidermis devoid of stomates).

Adventitious, at first cellular, then woody axis continuous with fibro-vascular plexus of stem, a cortical parenchyma continuous with inner part of that of stem, growing point surmounted by dense cellular tissue or pileorhiza,* which is more or less persistent, growing point being within; at point where root first thrusts its way the ruptured epidermis appears as a sheath or coleorhiza: secondary adventitious roots arise in monocotyledones from the vascular ring piercing cortical parenchyma: in dicotyledones they appear to be branches or divisions of the apices.

Axial, continuation of stem, circular group of fibro-vascular bundles as in stem, converging at collum, pith often absent, medullary rays present, liber bundles absent, cambium region passing at once into cortical parenchyma, diameter increased by wood formed in the fibro-vascular bundles, woody axes of branches divisions of main root.

STEM STRUCTURE.—*Dicotyledonous, first year:* central parenchyma forming the medulla or pith surrounded by circle of vertical anastomosing vascular bundles, outer part of which prolonged upwards, inner part branching into leaves, cortex cellular. *Dicotyledonous, second year or more:* medulla central parenchymatous, medullary sheath vascular, medullary rays of compressed parenchyma proceeding through the wood plates to bark, wood prosenchymatous with ducts, cambium layer enveloping wood forming wood cells on inner portion, liber cells on outer, (cambium remaining, *i.e.* indefinite); bark, three divisions often distinguishable—endophlœum, liber or inner bark;

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* Pileorhiza in common with other roots.

mesophlœum, green cellular envelope; epiphlœum, corky layer and epidermis composed of tabular and muriform parenchyma. *Monocotyledonous, herbaceous forms:* parenchyma interspersed with isolated (stringy) fibro-vascular bundles, terminating at surface of stem below and in leaf above; fibro-vascular bundles mostly definite or unprovided with a cambium, hence no increase in diameter after first year's growth, being terminated at fall of leaf; cortical layer imperfect. *Monocotyledonous, older forms:* parenchyma often woody from deposits, fibro-vascular bundles curved above towards surface of stem (leaves fallen), and their ends forming a net-work, separating imperfect cortical layer, are often provided with a power of development analogous to that of a cambium region, hence instances of increase in diameter; but the increase is only at the extremities of the bundles, not, as in dicotyledonous structures, along the whole length. Stems increase in length by their growing points (buds). The student must trace development of adventitious roots and buds from the extremities of vascular bundles of monocotyledones.

LEAF STRUCTURE.—Expanded layer of parenchyma interspersed by fibro-vascular bundles, proceeding from the liber and medullary rays of stem, and covered on surfaces by epidermis; floral organs more delicate in structure, fibro-vascular bundles mostly consisting of spiral vessels. Cortical system, *i.e.* epidermal in herbaceous compound organs—*simplest form:* a layer of flat cells, united by their sides, forming a continuous coating over surface of plant; impervious in submerged parts and roots; perforated by stomates in parts exposed to the air; cells containing no chlorophyll. Variable in form, often papillose or even prolonged into hairs, scurf, thorns, or prickles (not spines); outer wall of epidermal cells often cuticular; epidermal cells soon become thickened by deposits, and in older structures give way to cortical layer. Closely connected with the epidermis are many organs of the secretory system, such as glands and stings.

Glands, as regards number of cells, simple or compound; as regards situation, external or internal: *e.g.* Labiatæ, simple external; Lauraceæ, simple internal; Droseraceæ, compound external; Hypericaceæ, also rind of lemons, &c., compound internal.

Sting.—Stiff-pointed hair, expanded into bulb at base, which is surrounded by a layer of cells exerting pressure by their tension.

Intercellular spaces form what is called the ærial system, and are frequently in communication with the stomates or orifices of crescent-shaped cells, situated at the angles of the epidermal cells; at other times these spaces are bounded by membrane, and form part of the secretory system, such are lacticiferous vessels (cinenchyma), reservoirs, &c.

NOTES ON SYSTEMATIC BOTANY.

WILD FLOWERS AND THEIR RELATIONS.

MONOCOTYLEDONES.

General Characters.—Root, adventitious and coleorhizal. Stem, cellular and fibro-vascular tissue intermixed, bark inseparable. Leaves entire, sheathing, parallel venation longitudinally convergent or divergent, or lateral veins at nearly right angles to mid-rib. Flowers ternary.

Spadicifloræ, stamens hypogynous, spadix.

- Aroideæ, spathe; perianth O.
- Typhaceæ, no spathe; perianth, hairy, scaly, O.

Glumifloræ, stamens hypogynous, perianth of membranous bracts.

- Cyperaceæ, stem solid, leaf sheath entire, glume 1, trigyn.

Graminaceæ, stem fistular, leaf sheath split, glumes in pairs, digyn.

Petaloideæ, trimerous petaloid perianth, rarely scaly.

Stam. perig. ov. superior.

- Juncaceæ, leaves grass-like, perianth glumaceous.
- Palmaceæ, leaves pinnate or palmate, perianth glumaceous.
- Alismaceæ, carpels numerous, seeds exalbum., stamens more than 6.
- Asparaginaceæ, isostemonous 4—6—8, ft. often baccate.
- Melanthaceæ, hexandrous, extrorse, caps. septicidal.
- Liliaceæ, hexandrous, introrse, caps. loculicidal.

Stam. epig. ov. inf.

- Amaryllidaceæ, hexandrous, introrse.
- Iridaceæ, triandrous, extrorse.
- Orchidaceæ, gynandrous, irregular, ovary 1-celled.
- Marantaceæ and Zingiberaceæ have irregular flowers.

Aroideæ.—Arum maculatum, wake robin, (Portland sago). Acorus calamus, sweet flag. Found in conservatories are Richardia africana, trumpet lily with white spathe, and members of the genera Philodendron and Anthurium with pinkish spathes.

Typhaceæ.—Typha ang., T. lat., reed mace, ditches; spikes cylindrical, fil. 1, anth. 3. Sparganium ramosum, S. simp., peculiar rhizome and inflorescence, fruit arranged in a dense globose head.

Cyperaceæ.—Perianth very simple. Carex, perianth utricular (perigynium). Eriophorum, cotton grass, perianth a tuft of hairs. Scirpus, perianth a circle of bristles. C. hirta, C. aren, German sarsaparilla. The famous Papyrus antiquorum belongs to this order.

Graminaceæ.—*Note: bracts*, glumes; *calyx*, paleæ or glumellæ, the inner or upp. one called the flowering glume, often notched; *corolla*, hypogynous scales or lodiculæ; many of these parts are often absent. The student is referred to types for the genera Hordeum, Avena, Triticum, barley, oat, wheat.

H. murinum is a common weed. T. repens, couch grass. Genera often recognisable at sight, many have only a few individuals, but these are mostly very common, *e.g.* Cynosurus crist. raceme spike-like, bracts pectinate. Lolium perenne, spike flattened distichous, very common. L. temulent., darnel. Dactylis glomerata, pan. spikelets dense ovate, paw-like. Phalaris canar., canary grass. Holcus mollis, H. lan., soft grass, panicles white or reddening. Phleum prat., pan. cylind. appar. a spike. Arrhenotherum avenaceum, oat grass, arista long, kneed, from lower flower. Aira, hair grass, pan. lax, fl. 2, gl. eq. fl. aris. dorsal, kneed, arising from base of pale. Bromus, multifl., ax. long asperous, gl. short of lowest fl. veins of pale converg. below the tip into long arista (awn). Festuca, pan. multifl., low. pale rounded on back, acute, dorsal vein terminating in short awn. Pan. multifl. without awns, are: Melica, fl. 1—2, glumes scarious, pale rounded; Briza, quaking grass, fl. 3—8, pan. diverg. locustæ pend., pale rounded obtuse; Poa, meadow grass, pale scarious, obtuse, compressed. Three gen. have a 1-fl. spikelet and awns. Anthoxanthum odor., vernal grass, pan. spike-like interrup., fertile fl. diand.; sterile, with dorsal awn. Alopecurus, dense spike-like, awn at outer base of single pale. Agrostis, bent grass, lax, pale uneq. smooth, one furnished on back with awn; upp. gl. smaller.

Note.—Oryza sativa, rice; Zea mays, maize. Andropogon, various E. Indian species yield vetiver, lemongrass oil, spikenard oil, *e.g.* A. calamus aromaticus.

Alismaceæ.—Alisma, water plantains. Butomus umbellatus, flowering rush.

Palmaceæ.—Exotic or conservatory trees or shrubs. Reticulum, the stipular appendage.

Phœnix dactylifera, date. Cocus nucifera, cocoanut. Areca catechu, betel nuts. Calamus draco, dragon's blood (one source). Elais guineensis, palm oil. Stems of various species yield sago. Mem. Coquilla nuts, vegetable ivory, porcupine wood.

Juncaceæ.—The cymose panicle is sometimes called Anthela.

Juncus, rushes, leaves cyl. or keeled. Luzula campestris, meadows, a few inches high, l. flat, fl. 3—4 clusters, fil. shorter than anther. Narthecium ossifragum, bog asphodel, yellow browned, l. ensiform, fil. wooly, anthers brown; this pretty little plant is unlike a rush.

Melanthaceæ. — Colchicum autumnale, purple, leaves vernal. Tofieldia palus. Scotch asphodel, allied to Narthecium, introrse.

Note.—Asagrœa officinalis, veratria. Veratum (three caps. distinct), V. album, V. viride, V. nigrum, V. sabadilla. These are called hellebores: less confusion would arise by using the generic name instead of hellebore. (*See* Ranunculaceæ.)

Asparaginaceæ.—Order broken up, many put with lilies.

Paris quadrifolia, hermaph. (Trilliaceæ). Tamus communis, diœcious (Dioscoreaceæ). These plants are remarkable for their reticulated venation, and are often put into a subdivision Dictyogenæ. Tamus is found climbing in our hedgerows, l. shining cordate-acute. Asparagus off., asparagus. Polygonatum (var.), Solomon's seal. Convallaria majalis, lily of the valley. Ruscus aculeatus, habit of box, peduncles foliaceous remarkable.

Note.—Smilax (Smilaceæ), Sarsaparilla genus. Dracœna draco, true dragon's blood.

Liliaceæ.—Tulipa and Scilla, nearly polypetalous.

Tulipa, yellow, rare. S. verna., S. autum., bluish. Ornithogalum, Bethlehem star, yellowish or white. Endymion nutans, blue bell, perianth tubular, fil. decurrent. Muscari neglectum, grape hyacinth, dark blue, per. globose, fil. not decurrent. Allium, umbel surrounded by 2-valved spathe.

Note.—Urginea Scilla vel maritima, squill. Aloe, vulgaris, spicata, socotrina. Allium cepa, onion. A. porrum, leek. A. sativum, garlic. A. schœnoprasum, chive. A. ascalonicum, shallot. A. scoroprasum, rocambole.

Amaryllidaceæ. — Narcissus pseudo-narcissus, daffodil; N. biflorus, pale yellow. Galanthus nivalis, snowdrop. Leucojum vernum, snowflake.

Iridaceæ. — Iris pseud-acorus, yellow flag; I. fœtid., gladdon, per. 6-cleft, three inter. small and straight, stigmas petaloid, l. ensiform. Gladiolus, bulb solitary, per. irreg. Crocus, bulb double, per. regular, a bundle of linear leaves arising from bulb. C. vernus, vernal, purple. C. nudiflorus, autumnal, purple.

Note.—Crocus sativus, saffron. Iris florentina, orris.

Stamens in this order often long; anthers becoming apparently introrse. Proper position may often be traced by furrow on filament.

Orchidaceæ.—The most remarkable part is the labellum, which often gives the flower an insect appearance; its parts are—hypochilium, lower part; mesochilium, middle part; epichilium, limb; its proper position is posterior, but by the twisting of the (pedunculous) ovary it may be anterior, anthers on clinandrium turned away from labellum, pollen in masses or pollinia with caudicle or tail, near the extremity of which is often a glandular portion or retinaculum; the gynizus or position of the stigma is towards the labellum. The genus Orchis is distinguished by its spur. O. masc. early purple, O. Morio, green winged, have a 3-lobed labellum, tubers furnish salep. O. pyramidalis and Ophrys apifera are very handsome.

Note.—Vanilla, fruit of V. sativa, sylvestris, pompona (S. Amer.).

Marantaceæ.—Maranta, arrowroot; Canna, tous-les-mois.

Zingiberaceæ.—Ginger, cardamoms, grains of paradise or Guinea grains, turmeric. Alpinea galanga, galingale root.

DICOTYLEDONES.

General Characters.—Root, a direct prolongation of axis, exorhizal. Stem, cellular and woody tissue distinct, bark separable. Leaves articulated, venation reticulated. Flowers quinary or quaternary.

I. APETALÆ. *(Incomplete, often imperfect).*

Amarantaceæ.—Hypostaminous. Cock's comb. Prince's feather.

Chenopodiaceæ.—Hypos. and peris. Beet, spinach, chenopodia.

Peristaminous, i.e. stamens perigynous ; mostly trees.

Lauraceæ.—Note : Laurus nobilis, sweet bay. Sassafras officinale. Camphora officinarum, camphor. Cinnamomum Zeylanicum, cinnamon. C. arom., cassia.

Urticaceæ.—Ft. a monospermous nut, seed erect. Stinging nettles; wall pellitory.

Thymelaceæ.—Perianth tubular long, stamens on tube, no. double div. of per. Daphne mezereon, red, ft. red; D. laureola, yel., ft. black.

Polygonaceæ.—Stip. ochreate, ft. trigonal, embryo inverted.

Rheum, per. hexapartite, enneandrous. R. palmatum, rhubarb.

Rumex, per. 3 hex. interior envelop. ft., hexandrous.

Polygonum, per. pentapartite, pent. octan., digyn. or trigyn., ft. naked. P. fagopyrum, buckwheat. P. bistorta and P. viviparum are both rhizomatous. P. persicaria, pinkish, common, ochreæ loosely fringed. P. hydropiper, whitish, lax, common in ditches, taste hot, och. ventricose glandular. P. aviculare, smaller than foregoing, procumbent. P. convolvulus, habit of a bindweed (convolvulus).

Rumex, docks, two with acid herbage, known as sorrels, viz., R. acetosa, per. segm. reflexed, tubercled at base; R. acetosella, no tubercle, segments ascending, diœcious.

Artocarpaceæ.—Order subdivided: Cannabinaceæ, cannabis, humulus; opp. diœcious, accrescent, exalbuminous. Moraceæ, morus, ficus, alt. unisexual, albuminous. Ulmaceæ, ulmus, hermaph. or polygamous, samara exalbuminous.

Note.—Ficus carica, fig. Dorstenia (var.), contrajerva.

Coniferæ.—Polycotyledonous, supposed gymnospermous.* British are—Taxus baccata, yew; Juniperus communis, J. nana, junipers; Pinus sylvestris, Scotch fir. Many more cultivated. 1. Abietineæ fertile fl. in cones, ovules 1—2 inverted, at base of scales. The following have all two seeds adnate to scales, and bilocular anthers:—Abies, Larix, Cedrus. 2. Cupressineæ, ov. erect, ft. an indurated cone or galbulus, pollen spheroidal. Cupressus, Juniperus, Thuja.

Pinus, l. 2—5 fasc., cone scales with thickened ends (apophyses). P. maritima, Bordeaux and elsewhere. P. palustris, Amer. P. sylvestris. P. tæda. Pitch, tar, resin, turpentine, frankincense.

Abies, l. solitary flat, scales deciduous. A. nig., excel., canad., spruce firs. A. pectinata, silver fir, Strasbourg and Venice turpentine. A. balsamea, Canada balsam; this plant is called Balm of Gilead Fir (caution).

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* Naked seeds; angiospermous, seeds enclosed.

Cedrus, l. fasc. tetragon., perennial. C. libani (red cedars to gen. Junip.)

Larix, l. 5—20 fasc. flat, annual. L. europæa, larch, Venice turpentine.

Cupressus, galb., many scaled, apophyses valvate (meeting) many ovules in axil. C. sempervirens, cypress.

Thuja, scales of galb. imbricated, two ovules in axil (arbor vitæ).

Juniperus, galb. 3 fl. ovules 1—2 at base of scale, carpels coher. becoming fleshy. J. sabina, savine, imbricated acuminate leaves (convex, not flat). J. oxycedrus, yields Huile de Cade.

Salicaceæ.—Amentiferous, diœcious, ft. 1-cel., valves 2, seeds comose.

Salix viminalis, osier; about thirty other species of willow native.

Populus tremula, aspen; three other native species found in damp places—alba, nigra, canescens.

Betulaceæ.—Amentiferous, monœcious, ovary 2-cel. 2 ov., ft. unilocular monosperm. seed pendulous, not hairy.

Betula alba, B. nana, birches, ft. winged. Alnus glutinosa, alder, ft. compressed, not winged.

Epistaminous, i.e. Stamens epigynous.

Cupuliferæ.—Amentiferous, monœcious, hexandrous, l. pinnate. About a single native example of each genus.

Carpinus betulus, hornbeam, in clusters, cupule of two open foliaceous, tripartite bracts. Corylus avellana, hazel. Quercus robur, oak. Castanea vulgaris, sweet chestnut. Fagus sylvatica, beech.

Note.—Q. tinctoria, quercitron. Q. infectoria, galls. Q. suber, cork. Q. ilex, evergreen oak. Trace the variations of cupule in this order.

Aristolochiaceæ.—Gynandrous (hexandrous). Two native examples.

Aristolochia clematitis, creeping, yellowish, irregular, caps. hexagonal, hexalocular. Asarum europæum, asarabacca, fl. green, solitary, drooping between two reniform leaves (stam. 12).

Note.—Aristolochia serpentaria, serpentary, N. Amer. Apetalous flowers may occur in Primulaceæ and Oleaceæ.

II. GAMOPETALÆ.

Hypocorollifloral.

Apocynaceæ. — Ovaries 2. *Ex.* Vinca, periwinkles, Hoya.

Note.—Hemidesmus indicus, Cynanchum argel (Asclepiadaceæ). Strychnos, Nux-vomica. Spigelia mar., Carolina pink (Loganiaceæ).

Jasminaceæ.—Regular flowers, diandrous.

Syringa vulgaris, lilac. Fraxinus, ash. Ligustrum vulg. privet.

Note.—Fraxinus ornus, manna. Olea europæa, olive (Oleaceæ).

Plantaginaceæ.—Inflorescence spicate; calyx bractlike, scarious; stam. long.

Plumbaginaceæ.—Calyx bractlike, scarious; stam. opp. segments of coral; stig. 5.

Armeria vulgaris, common thrift, gardens, capitula. Plumbago. Statice.

Verbenaceæ.—Ft. drupaceous, nuts 1—4. *Ex.* Verbena offic., vervain.

Lentibulariaceæ.—Aquatic, irregular, diandrous, placentaries central.

Pinguicula, butterwort. Utricularia, bladderwort.

Primulaceæ.—Stam. opp. segments of corolla; plac. central; style simple.

Primula veris, cowslip. P. vulgaris, primrose. Anagallis arvensis, scarlet, rarely blue, shepherds' weather-glass. Lysimachia nummularia, yellow, moneywort. Glaux maritima, apetalous, seashores. Cyclamen. Hottonia. Samolus. Centunculus.

Gentianaceæ. — Leaves opposite, ribbed, placentaries parietal. Figures in this order and following ones, unless qualifying, refer to the floral whorls from calyx to pistil.

Chlora perfoliata, yellow, 8.8.8. Cicendia, yellow, 4.4.4. Gentiana (var.), blue, 4—5. Erythræa (var.), pink, centaury. Villarsia, yellow, rivers, rare, leaves alternate. Menyanthes trifoliata, flesh-coloured, bogs.

Note.—Ophelia chirata, India. Gentiana lutea, Alpine.

Convolvulaceæ. — Habit twining; calyx imbricated; dehis. septifragal.

Convolvulus sepium, large, white or pink, bracts close to flower. C. soldanella, pink with yellow bands, sea shores. C. arvensis, common, bracts small, distant from flower. Cuscuta, dodders, tinted, leafless, parasitic.

Note. — Conv. scammonia, scammony. Exogonium purga, jalap.

Orobanchaceæ.—Fleshy, parasitic, didynamous. Broom rapes. These may be mistaken for orchids or scrophulariads. Ovary in fleshy disk, plac. parietal.

Scrofulariaceæ.—Irregular (some forms pelorian), personate with rictus or chink, others labiate, didynamous, ovary and fruit 2-celled, plac. axile. Plants exhibiting many forms of dehiscence. Note the anisomerous flowers and antero-posterior cells of fruit, also the gradual emergence of the lateral veins in the leaves of digitalis and others.

Veronica, blue, diandrous, speedwells. Verbascum, mulleins, yellow, pentandrous. Scrophularia, fig-worts. S. nodosa, biserrate, lower teeth larger, staminode* transv. oblong, emarginate. S. aquatica, crenate, serrate, cymes corymbose, staminode roundish, entire. Antirrhinum, purplish, personate, no spur. Linaria, toadflax, often yellow, personate, spurred. Melampyrum, cow-wheat, calyx tub. 4—5, div. setaceous, seeds 1—2. Pedicularis palustris, P. sylvatica; calyx inflated, 5-toothed, l. pinnatifid. Rhinanthus, calyx inflated, 4-toothed. Euphrasia offic., wiry, a few inches high, heaths, and E. odontites, much branched, a foot high, have bicornate anthers. Digitalis purpurea, foxglove, 3—4 feet high; corol. campanulate; petiole winged; lamina ovate, lanceolate, crenate, downy beneath; sepals 5, irreg. ovate, oblong, acute.

Solanaceæ.—Regular, isomerous, pentandrous, embryo urved or spiral.

Solaneæ, æstivation valvate; anthers with porous dehiscence. Solanum. Atropeæ, æstivation imbricate, anthers dehiscing longitudinally. Solanum, cor. reflexed, anthers erect, connivent. S. nigrum, white, common, ft. turning black. S. dulcamara, purplish, with two green spots at base of segment, ft. red, heterophyllous, upper hastate, lower cordate, ovate. S. tuberosum, potato. Atropa belladonna, corolla campanulate, coppery purple, berry (nuculanium) violet black. Hyoscyamus niger, corolla infundibuliform, irregular, yellow with purplish veins, capsule a pyxidium; species vary in intensity of colour; compare the structure of this fruit with that of digitalis, placentation in both cases axile; put the septa when fresh under the microscope. Datura stramonium, white, D. tatula, purplish, caps. densely spinous, spuriously 4-celled

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* Examine upp. part of corolla within.

(compare cor. and ft. of Conv. sep.). Lycium barbarum, lilac colour, ft. red, shrub straggling, spinous; gardens, walls, &c. Physalis alkakengi, winter cherry, gardens, ft. globose, enclosed in accrescent calyx.

Note.—Sol. melongena, egg-apple. Lycopersicum esculentum, tomato. Mandragora officinalis, mandrake. Capsicum annuum, capsicum. C. fastigiatum and C. frutescens, cayenne pepper.

Boraginaceæ.—Regular (or nearly so), pentandrous, ovary 4-lobed.

Bor. Sym. Cyn. Myos., corol. append. in mouth, stigma simple (Cyn. bifid.). Pul. Ech. Lith., corol. without append., stigma bifid (Lith. off. has scales). Borago officinalis, borage, blue, rotate, throat scaly, 12—18 inches high, stamens exserted, conniving in cone. Anchusa, alkanet, 2 feet high, infundibuliform, stamens included, subsessile. A. offic., purple, l. lanceolate. A. sempervirens, blue, l. ovate. Lithospermum, cal. and cor. divided to base, ft. osseous. Pulmonaria offic., lungwort, cal. 5-ang., cor. 5 tufts of hair at mouth. Echium vulgare, viper's bugloss, bluish, spikes short lateral, cor. irreg., limb obliquely truncate. Cynoglossum offic., crimson, infundib., upper leaves lanceolate, narrowed below (2 feet high), stigma tailed, nuts roundish. Myosotis palustris, forget-me-not. Symphytum officinale, comfrey, white, purple, campanulate, lobes short, stem winged above, l. very decurrent.

Note.—Mertensia maritima, oyster plant, northern sea shores. Anchusa, alkanet.

Labiatæ.—Irregular, didynamous, ovary 4-lobed.

Salvia, diandrous, connective prolonged, one anther cell barren. S. Verbenaca, purple, English clary, upp. leaves broad. Lycopus europæus, nearly regular, diandrous; fl. small, in dense whorls, ditches. Rosmarinus officinalis, diandrous; gardens. Nepeta glechoma, ground ivy; bluish, very common, its cordate reniform crenate leaves found all the year round. Thymus, wild thyme: T. serpyllum, creeping, upp. lip of corol. oblong; T. chamædrys, ascending, upp. lip of corol. semicircular. Melissa officinalis, white, balm or citronella, gardens; cal. and cor. 2-lipped, upp. lip of cal. 3-toothed, of cor. concave. Origanum vulgare, marjoram; spikes 4-sided, purplish ovate bracts exceeding the 5 equally-toothed calyx. Calamintha, purplish, tips of stamens converging under upper lip. C. clinopodium, bracts many, setaceous, forming involucre. Prunella vulgaris, blue, self-heal; spikes blunt, bracts reniform, fil. bifid., one branch barren, anth. 2-celled. Scutellaria galericulata, blue large, longer stam. inferior with fil. simple and anth. 1-celled.

Mentha, 5.4.4, regular, stamens distant (equal, not didynamous). M. pulegium, pennyroyal; this is the only mint with throat of calyx hairy;[*] it is also the smallest of the species. *General inflor. definite:* M. rotundifolia, sessile, crenate, serrate, wrinkled, shaggy beneath, bracts lanceolate. M. sylvestris, horse mint; subsessile, serrate, silky, bracts subulate. M. viridis, spear mint; glabrous, subsessile, bracts subulate, spikes lax. M. piperita, pepper mint; stalked, spikes lax, short, blunt, interrupted below. M. aquatica, capitate mint; stalked, uppermost leaves falling short of the fl., whorls subglobose. *General inflor. indefinite:* M. arvensis, corn mint; stalked, upp. leaves as large as the others, calyx with triangular teeth as broad as long. M. pratensis, nearly or wholly sessile, floral leaves exceeding the fl., whorls, subglobose distant, calyx campanulate. M. sativa, whorled hairy mint (not M. viridis); stalked, all exceeding the fl., calyx teeth triangular, lanceolate.

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[*] L. us.

Ajuga reptans, bugle, blue, and Teucrium scorodonia, yellowish, wood sage, have a very short bifid upper lip to corolla.

The following labiates have these common characters—two inferior stamens longest, stamens and anthers approaching, and, except marrhubium, exceeding corolla tube, calyx 5-toothed.

Marrhubium vulgare, white horehound; leaves ovate, hoary, calyx teeth 10, subulate. Ballota fœtida, rough, common plant, and B. ruderalis, rare, known by their infundibuliform calyx, with equal teeth folded longitudinally. Leonurus cardiaca, purple crowded, mother wort, rare; 3 feet high, quinque-palmatifid, cor. upp. lip flat, lower trilobate blunt, anth. cells parallel. Melittis melissophyllum, purple or variegated, calyx memb., cor. upp. lip flat, anther cells cruciform. Galeopsis, hemp nettle; cal. teeth spiny, corolla large, anthers 2-celled, bursting transversely by two valves (valv. dehis.). G. ochroleuca, yellow; cor. upp. lip deeply notched (Caution—resembles the ordinary white dead nettle, which also dries yellow). G. ladanum, purple variegated; cor. upp. lip slightly notched. G. versicolor, yellow; purple spot on lower lip, tube far exceeding calyx. G. tetrahit, purplish varieg.; nodes thickened hispid, cor. tube equalling calyx. Lamium, ringent, cor. low. lip large, obcordate, with one or two lateral teeth (L. galeobdolon, low. lip tridentate). L. album, white dead nettle. L. maculatum, spotted leaves; gardens. L. purpureum, red dead nettle; magenta in bud. Stachys, purplish, wound worts; anthers dehis. longitud., turned towards margins of corol. after dehiscence. S. sylvatica, common, cordate, ovate, floral linear entire bracts minute. S. betonica, betony, woods, cal. glab. S. annua, yellow, local. (Lythrum salicaria, polypetalous — *see* Lythraceæ — has the habit of a stachys.)

Note.—Lavandula vera, lavender oil, l. linear lanceolate. L. spica, spike oil, l. obovate or spathulate. Orig. marjorana, sweet marjoram. Pogostemon patchouly, patchouly. Satureia, savory. Marrhubium vulgare, horehound.

Pericorollifloral, stamens scarcely epipetalous, but inserted with corolla around the ovary, perigynous.

Ericaceæ.—Ligneous, ovary superior (vac. inf.), fruit baccate or capsular, corol. white-pink 4—5, st. 8—10.

Arbutus, Arctostaphylos, Vaccinium; petals cohering, berry globose 5-cell.

Pyrola, Moneses, Monotropa; petals scarcely cohering, decandrous, capsule dry, testa loose, no disk.

Andromeda, Calluna, Erica, Phyllodoce, Dabeocia, Azalea; petals cohering, capsule dry, testa close.

Many genera have only one indigenous example, and these are mostly, unless cultivated, Irish or Scotch, *e.g.* :—

Arbutus unedo, strawberry tree; berry scarlet tuberculated, cells many-seeded : compare strawberry.

Moneses grandiflora, anther cell furnished with tubular horn opening at end, stigma radiant.

Monotropa hypopitys, yellow bird's-nest; petals with hooded nectariferous base, anth. trans. dehis. (octan.).

Andromeda polifolia, fl. pink (compare Arbutus). Dabeocia polifolia, filam. flattened, shorter than linear anthers, stigma simple truncate. Phyllodoce cærulea, cal. 5-parted, decandrous, filaments slender, longer than short truncate anthers, stigma peltate, 5 tubercles.

Azalea procumbens, pentandrous, anth. long. dehis., capsules with bifid valves, inflexed edges, forming double partitions.

Calluna vulgaris, ling, very common; cal. 4-pt. longer than 4-clft. fading lilac rose corolla, caps. septicidal dehiscence.

The genera having more than one representative individuals are—

Arctostaphylos, berry smooth, cells 1 seed. Vaccinium, berry inferior, umbilical, cells many seeds.

Erica, capsule loculicidal dehis. Pyrola, wintergreen; each anther cell dehiscing by pore at base, style 5-lobed.

A. uva ursi, l. coriac, obovate, entire, shining, berry scarlet. A. alpina, l. thin, wrinkled, serrate, berry black. V. myrtillus, bilberry, l. deciduous, ovate, serrate, anthers bicornate, berry black. V. uliginosum, bog whortleberry, l. deciduous, obovate, entire, glaucous,* veined beneath, anthers bicornate, berry black. V. vitis-idæa, red whortleberry, l. evergreen, obovate, dotted beneath, crenate, cor. campanulate, anthers without horns, berry red. V. oxycoccos, cranberry, l. evergreen, ovate, entire, glaucous beneath, cor. rotate, anthers without horns, berry red.

Erica, heath. E. tetralix, l. 4 in whorl, l. upper surface, mid-rib below, linear sepals and ovary, all downy. E. cinerea, l. 3 in whorl, keeled beneath with central furrow glabrous, inflores. dense whorled racemes. Others are local—Mackay's, Cornish, &c.

Pyrolæ, cal. 5 pt., no disk (Moneses and Monotropa, no disk); anth. cells, with porous dehiscence at base, style 5-lobed.

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* Glaucous; green with a sort of bloom or whitish-blue lustre.

Note.—Arc. uva ursi, bearberry. Chimaphila umbellata, winter green.

Campanulaceæ.—Herbaceous, blue, pentandrous, ovary inferior.

Lobelia, cal. odd segment anterior, cor. irreg., syngenesious; two examples—one aquatic, other local. Other plants have the odd segment of calyx posterior and regular flowers.. Jasione montana, syngenes., caps. dehis. by minute teeth. Phyteuma orbiculare, heads globose, cor. bilabiate, with five linear segm. Campanula rotundifolia, harebell. C. latifol., giant bell flower. C. trachelium, nettle-leaved bell flower. C. patula, pan. lax, long erect, cal. seg. toothed at base.

Note.—Lobelia inflata, Indian tobacco (Lobeliaceæ).

Styracaceæ.—Exotic. *Note*—Styrax benzoin, benzoin. S. offic. storax.

Epicorollifloral; anthers free, except in Compositæ, where they are syngenesious.

Caprifoliaceæ. — Shrubs, exstipulate, opposite, calyx adherent, &c.

Viburnum, simple dentate, berry monospermous. Sambucus, pinnate, berry trilocular trispermous. Lonicera, irreg. tubular, style filiform, stig. capitate. Cornus (Cornaceæ) tetrapetalous, style 1, drupe with 2-celled nut.

V. Opulus, guelder rose, l. 3—5 lobed, berry red. V. lantana, wayfaring tree, oblong, serrate, denticulate, berry black. S. ebulus, dwarf elder, herbaceous, stipules foliaceous. S. nigra, elder, arborescent, stipules inconspicuous. C. sanguinea, dogwood, gattridge or skewer wood. Closely allied to Cornus is the Cuba laurel. Symphoricarpus, snowberry tree.

Valerianaceæ.—Flesh coloured, not capitulate, cal. simple, cor. 5-lobed, di-tri-androus, stigma lobed.

Centranthus ruber, red valerian, gardens; cor. spurred, monandrous, fruit unilocular. Valerianella, cor. rarely spurred, triandrous, ft. crowned by jagged not pappose limb of calyx, 3—1 cell. Valeriana, no spur, calyx becoming pappose, triandrous, ft. 1-cell.

Note.—Nardostachys Jatamansi, Indian spikenard. Valeriana celtica, celtic nard.

Dipsacaceæ.—Capitulate, cal. double, cor. 4—5 cleft, purplish blue, tetrandrous. Teazels.

Dipsacus, recep. with spinous scales. Scabiosa, recep. scaly, calyx 4—5 bristles. Knautia, recep. hairy, not scaly. (Apices of calyx may be mistaken for recep.) D. sylv. gen. inv. curved upwards. D. fullonum (not wild), gen. invol. spreading. D. pilosus. gen. inv. shortly deflexed, petiolate, leaves lateral, leaflets at base. Scabiosa succisa, involucel herbaceous, hairy (involucel outer part of double calyx). S. columbaria, involucel membranous, plaited, notched. Knautia arvensis, involucel toothed. Three last plants differ in leaves, size of capitula, and in their gen. involucres, but are much alike in appearance.

Rubiaceæ.—Entire leaves, regular flowers. Indigenous plants belong to the suborder Galiaceæ. Stipules interpetiolar, leaf-like, forming verticels, fruit dry (except Rubia), 1—2 cel., one erect ovule in each. Other suborders are: I. Coffeæ, stip. small, ovary 1—2, seeded, include Coffeæ, Psychotria, Cephaëlis, Richardsonia. II. Cinchoneæ stipules small, seeds numerous. Cinchona, Gardenia.

Galiaceæ. Rubia peregrina, madder; stem terete, shoots quadrate, ft. fleshy 2-lobed. Sherardia arvensis, field madder; a few inches high, lavender coloured corolla, calyx deeply 6-toothed. Asperula, cor. infundibuliform, ft. not crowned by calyx. A. odorata, white, woodruff l. 6—8 in whorl. A. cynanch., lilac, l. 4 in whorl. Galium, cal. inconsp., cor. rotate, ft. 2. nuts. G. verum, pan. dense golden yellow, l. 8, linear setaceous. G. cruciatum, yellow, l. 4 (3-veined). G. boreale, white, l. 4 (3-veined), ft. with hooked bristles. G. aparine, pale, l. 6—8 (1-veined), ft. with short hooked bristles. The other galia have 1-veined leaves, and (except G. palustre 4) 6—8 in whorl, white flowers, smooth or granular fruit. G. saccharatum, rare, ped. 3 fl., ft. warty. G. uliginosum, rough, with downward prickles, l. 6—8, linear lanceolate, margins rough, with backward prickles. The following have no downward prickles:—G. erectum, l. 8 lanc., ft. smooth. G. mollugo, l. 8 lanc. obovate, ft. smooth. G. saxatile, l. 6 obovate, ft. granular. G. sylvestre, l. 6—8 linear lanceolate.

Note.—Cephaëlis ipecacuanha, offic. ipecac. Psychotria emet., black or streaked ipecac. Richardsonia scabra et emetic., white ipecac. Uncaria gambir, pale catechu. Cinchona var., cinchona.

Compositæ.—Flowers consisting of florets arranged in capitula upon a common receptacle, surrounded by an involucre, of which the divisions are called phyllaries; fruit a cypsela, seed erect exalbuminous, anthers syngenesious. Several special terms are used in this order, thus:—

Capitulum (anthodium, calathium). Involucre (periclinium, periphoranthium). Receptacle, clinanthium. Homogamous, perfect (polyg. æqual. Linn.). Heterogamous, disk florets perfect, ray florets pistillate or neuter (polyg. sup. Linn.).

Heterocephalous, a monœcious form, some capitula entirely male, others entirely female, on same plant. Pappus; modified calyx.*

This order is variously subdivided, *e.g.* Tubulifloræ (*see* Corymbiferæ and Cynarocephalæ), Labiatæfloræ (exotic), and Ligulifloræ; or again into tribes from considerations of the styles and stigmatic lines (ventral) of the perfect florets. Genera of indigenous plants will be classified according to their tribes, but the plants themselves will be studied under other heads.

(1.) *Eupatorieæ.*—Style cyl., branches long, clavate, downy, lines prominent.

Eupatorium, Petasites, Tussilago.

(2.) *Asteroideæ.* — Style cyl., branches linear, flat, equally and minutely downy on outer surface, lines narrow.

Aster, Bellis, Erigeron, Salidago, Linosyris, Inula, Pulicaria.

(3.) *Senecioneæ.*—Style cyl., branches long, linear, ending in fringe, or else in bunch of hairs, lines broad, prominent.

Senecio, Bidens, Achillea, Anthemis, Matricaria, Chrysanthemum, Diotis, Artemisia, Tanacetum, Gnaphalieæ.

(4.) *Cynarocephalæ.*—Style thickened, and often tufted, below the free or united branches, downy externally, lines confluent (*see also* fl.).

(5.) *Ligulifloræ.* — Style cyl. above, branches long, blunt, equally pubescent, lines narrow, terminating below middle of branches (*see also* fl.).

Sub-Orders.

1. *Cichoriaceæ.*—Liguliforal, semiflosculous. Fl. homogamous, corolla strap-shaped (*see also* style), mostly yellow, rarely blue or purple.

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* To examine the pappus—gather a faded capitulum and place it in a dry or warm situation for a few days.

Cichorium intybus, blue, chicory, pappus coronate. Mulgedium alpinum, blue, local, pappus brittle. Tragopogon var., purple and yellow, leaves grass-like, involucre often exceeding capitulum, pappus stalked, feathery. Lapsana communis, 2 feet high, very common, pappus O. L. pusilla, rare, pap. coronate. Hypochæris radicata, common, recep. scaly with abortive florets, invol. short of fl., ft. all beaked, pap. feathery. Helminthia echioïdes, very rough and common, several loose bracts below capitula, prickles strong glochidiate arising from white tubercles. Picris hieracioïdes, peduncles rough with bracts and bristles, a row of spreading phyllaries at base of others, pappus feathery, exterior hair-like. Thrincia hirta, scape simple, leaves radical, nearly entire, marginal ft. enveloped in the phyll. with short crown-like pappus. Apargia hispida, scape simple, leaves radical runcinate, pappus of all the fruit in two rows, the outer bristly. A.* autumnalis, branched, glabrous, scaly, and thickened upwards, pappus in one row feathery. Taraxacum dens leonis, dandelion. Lactuca and Sonchus have compressed ft. and filiform pappus. L. virosa, l. horiz., oblong, mucronate, dentate or sinuate, beak eq. to black fruit. L. saligna, l. entire, acuminate, beak twice as long as fruit. L. scariola, rare, l. upright sinuate, beak equal to pale fruit. L. muralis differs from others in having a beak shorter than fruit, and leaves with smooth keel (author believes there is a prickly form). Sonchus, invol. ventricose at base, ft. not beaked. S. oleraceus, sowthistle, auriculate aur. spreading sagittate. S. asper., auricles rounded. S. arvensis, large, fœtid, corymbose. Crepis and Hieracium have terete ft. and filiform pappus. Crepis, inv. imb., exterior phyll. lax, ft. narrowed upwards, pappus soft. Hieracium, inv. ovoid, ft. truncate (not beaked), pappus fragmentary, often reddish. C. virens, common, outer phyllaries adpressed, inner ones glabrous within, ft. shorter than pappus. C. taraxacifolia, beak long, subulate (others rare). H. pilosella, common, lemon coloured, stoloniferous, scape a few inches high, leaves floccose. H. vulgatum, common, l. oblong lanceolate with forward teeth, phyll. equally attenuate (others rare).

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* Succus Apargiæ. *Ph. Journal*, 1872-3. Author.

II. *Cynarocephalæ.*—Fl. homogamous, flosculous, cor. often pinkish (*see also* style).

Centaurea, often heterogamous, inv. scarious, spinous, cornuate or pectinate at apex, pappus unequal in many rows, longest equal to ft., umbilicus lateral. C. nigra, cap. in æstiv. black, phyll. scarious, pectinate. C. jacea, phyll. append. rounded. C. cyanus, blue. C. scabiosa, purple, an outer row of radiant florets, l. pinnatifid. C. solstitialis, yellow starthistle, C. calcitrapa, common starthistle; phyll. glab., strong central spine channelled, l. pinnatifid. Serratula tinctoria, distinguished from Centaurea by its smooth adpressed phyll., and inner pappus being longer than the fruit. Saussurea, Carlina, Arctium, have two bristles at base of anthers. S. alpina, moist rocks, leaves woolly, pap. two rows, outer short bristly, inner feathery. C. vulgaris (a foot high), pap. in one row, branched, feathery, united into ring. Arctium, burdock, well known. Silybum marianum, milk thistle, l. very large, variegated, heads large globose, fil. monadelp., pap. in many rows, terminal scar of ft. surrounded by papillose ring. Carduus, pap. in many rows, equal, long, united into ring at base, phyll. spinous. C. nutans, heads solit. drooping, phyll. lanc., outer reflexed. C. crispus, heads roundish, phyll. linear subulate. Onopordum acanthium, cotton thistle, ft. 4-ribbed, pappus rough, recep. alveolate, otherwise like Carduus. Cirsium and Cnicus, now inincluded in Carduus, are distinguished by their feathery pappus.

III. *Corymbiferæ.*—Fl. of disk tubular and perfect, marginal fl. often ligulate, female or neuter (heterogamous). Style not swollen below branches (*see* tribes). Many may be introduced by their general characters, being like those of well-known representatives.

1*st type.*—Daisy, radiant fl. white, pappus O, recep. without scales. Bellis perennis, daisy. Chrysanthemum leucanthemum, ox-eye (C. segetum, yellow, corn marigold). Matricaria chamomilla, Mayweed, recep. con. hollow, leaflets long, filiform. M. inodora, more branched than former, leaflets filiform, short; two glandular spots may be seen by small lens at back of each unripe cypsela below the green elevated apex. M. parthenium, feverfew, l. pinnate, leaflets ovate, oblong, cut.

2*nd type.*—Like first, but recep. scaly. Achillea. Anthemis. Some of these, with yellow rays, are scarcely naturalized. Ac. millefolium, yarrow, well known. Ac. ptarmica, sneezewort, known at once from millef. by its larger heads and lanceolate serrulate leaves. Anth. tinctoria, ray yellow. A. arvensis, corn chamomile, ray white pistillate, recep. conical, scales lanceolate acute. A. cotula, stinking chamomile, ray white neuter, scales setaceous. A. nobilis, chamomile, ray white, scales membranous blunt, l. bipinnate, leaflets linear, subulate, acute.

3rd type.—Coltsfoot. Fl. generally radiant and yellow, pappus nearly always hairlike. Tussilago farfara, coltsfoot, very common early in spring, leaves later, annual. Senecio, inv. calyx-like, phyllaries blunt, scarcely membranous at margins, scales at base of involucre small. S. vulgaris, groundsel, common, no ray. S. sylv., 2 feet high, no ray. S. viscosus, autumnal, ray revolute, l. pinnatifid, very viscid. The other groundsels have a spreading ray; of these a few forms with entire leaves are very rare; the following with glabrous pinnatifid leaves common. S. aquat., wet meadows; lower leaves crenate, oblong dentate, ft. all glabrous. S. Jacobæa, l. leaves oblong, attenuate, lyrate-pinnatifid, ft. of disk hairy. S. tenuifolius, segm. of leaves linear, outer phyll. half as long as inner, ribs of ft. silky. Solidago virga-aurea, golden rod, heaths; stem simple, ending in pan. of fl., ray and pappus in one row. Inula, pappus uniform hairlike, in one row, anthers with two bristles at base. Pulicaria, pappus in two rows, outer cuplike, toothed or wanting, otherwise like Inula. I. helenium (like small sunflower), Elecampane, rare, 3—5 feet high, phyll. outer ovate, inner obovate. I. conyza, ploughman's spikenard, phyll. outer lanceolate, inner linear acute (leaves resembling those of digitalis), lateral branches ending in dense corymb. I. crithmoïdes, golden samphire, leaves fleshy, phyll. taper-pointed (Caution, *see* Umbell.), sea side. P. vulgaris, l. lanceolate, repand (wavy), narrow at base, rays short. P. dysenterica, l. oblong, ray exceeding disk. Bidens, brownish yellow, rarely radiant, recep. scaly, pap. of 2—3 dentic. spines. B. tripartita, l. stalked tripartite; B. cernua, l. undivided: these are called Bur marigolds, and are found in wet places. Tanacetum vulgare, flosc., 2—3 ft. high, infl. corymbose, fl. of circumference tridentate, ft. crowned by entire membrane, pap. O. Linosyris vulgaris, rare, cliffs, heads not radiant, somewhat the habit of a groundsel, but golden yellow. Doronicum pardalianches, rare, inv. hemispherical, phyll. 2—3 rows equal.

4th type.—Various. Petasites, vulg., whitish, compare coltsfoot. Eupatorium cannabinum, reddish purple, l. opp. digit. often trifoliate, with middle leaflet larger, elliptical acuminate, serrulate, corymbs dense. Erigeron canadense, habit of common groundsel, but a more bleached appearance, leaves entire. E. acris, blue fleabane, purplish, heads solitary, larger than E. can.; the many ranked subulate phyllaries are characteristic of the Erigerons, which are also good examples of the Asteroideæ. Artemisia absinthium, recep. hairy, in other wormwoods naked, l. silky, segments lanceolate blunt, pap. O. A. vulgaris, l. wooly beneath, segments lanceolate acuminate, bracts exceeding the lateral racemes, heads smaller than preceding. A. marit. homogamous, l. pinnatifid with linear blunt segments. A. camp., rare, l. silky, phyl. ovate glabrous, with scarious margins. Diotis marit., rare, cotton-weed, recep. scaly, ft. crowned by persistent auricled tube of corolla, pap. O. The Gnaphalieæ, comprising Gnaphalium, Filago, Antennaria, are cottony, mostly heterogamous plants, with a hairy pappus and rarely scaly receptacle.

Note.—Anthemis nobilis, chamomile. Anacyclus pyrethrum, pellitory. Artemisia absinth, wormwood. A. abrotanum, southernwood. A. dracunculus, tarragon. A. santonica, santonica. A. var., semencontra. Inula helenium, elecampane. Lactuca, lettuce. Cichorium intybus, chicory. Tussilago farfara, coltsfoot. Arnica montana, arnica. Calendula offic., marigold. Carthamus tinctorius, safflower. Taraxacum dens leonis, dandelion. Eupatorium ayapana, ayapana, Brazilian tonic. Helianthus annuus, sunflower. H. tuberosus, Jerusalem artichokes. Cynara scolymus, artichokes, *i.e.* receptacles.

III. POLYPETALÆ—A.

Hypopetalous, thalamifloral, plac. parietal.

Violaceæ, Resedaceæ, Fumariaceæ, *irregular.*

Cistaceæ, Droseraceæ, Papaveraceæ, Cruciferæ, *regular.*

Violaceæ.—Pentandrous, fil. dilated, stigma hooded, three parietal plac. on middle of valve.

Viola odorata. V. tricolor. V. canina. V. hirta. V. lutea. The Bixaceæ are closely allied, *e.g.* Bixa orellana. Annatto.

Resedaceæ.—Ov. 1-celled, three parietal plac., alternating with horns of capsule, ovules campylo. C.C. 5—6.

Reseda lutea, l. trifid or pinnatifid, R. luteola, l. undivided; mignionette.

Fumariaceæ.—Allied to Papaveraceæ; distinguished by absence of milky juice, irregular flowers, diadelphous stamens.

Fumaria, var., pinkish, ft. a nut. Corydalis lutea, yellow, pod 2-valved, many seeded.

Cistaceæ.—Violaceous, corolla rosaceous, rock roses.

Helianthemum, var., cal. 5, pet. 5, decid. yellowish, stam. many, cap. 3-valved.

Droseraceæ.—Bog plants related to Violaceæ. Vernation circinate, styles divided.

Drosera rotundifolia, rosette of saltspoon shaped leaves, remarkably glandular, scape a few inches, infl. scorpoid, cor. withering.

Papaveraceæ.—Herbs, with milky juice, disepalous, tetrapetalous, polyandrous.

Papaver, Meconopsis, ft. globular, oblong, or ovate, stigmas radiant. Roemeria, Glaucium, Chelidonium, stigmas 2, capsule 2-valved (R. 2—4). Chelidonium majus, celandine, common, yellow, plac. distinct. Glaucium luteum, horned poppy, seashores, golden yellow, plac. connected by spongy dissepiments (cerastium, horn). Roemeria hybrida, rare, violet blue, plac. distinct (stig. and valv. 2—4). Meconopsis cambrica, Welsh poppy, orange yellow, stigmas free. Papaver somniferum, rare, large bluish white spot at base of white petals, fil. dilated upwards, caps. glob. without bristles. P. dubium, large, pale red, fil. subulate, caps. clavate oblong, stigmatic disk becoming eavelike. P. lecoqii, (*see* dubium), but sap becomes dark yellow on exposure. P. rhœas, large, scarlet black, fil. sub., cap. roundly obovate, without bristles.

Note.—Sanguinaria canadensis, bloodroot. Papaver somniferum, opium. Sarracenia purpurea, Indian pitcher-plant. Argemone mexicana, purgative oil from seed.

Cruciferæ.—Tetrapetalous, tetradynamous. Yellow, white, pinkish. Ft. dicarpellary, incurved margins forming a replum. As regards position of radicle and cotyledons: accumbent, edges of cot. applied to radicle, rad. being lateral; incumbent, radicle dorsal or on back of cotyled.; conduplicate, cotyl. longitud. folded, rad. dorsal within the fold.

Sub-Orders.

I. *Nucumentaceæ.* — Silicle scarcely dehiscent, often 1-celled from absence of septum.

Isatis tinctoria, woad, rare; only example.

II. *Lomentaceæ.*—Silicle or siliqua dividing transversely into 1-seeded cells, seeds often only in beak.

Four examples: Cakile marit., purple sea rocket.

Crambe marit., sea kale, white, sil. 2-jointed. Raphanus marit., yellow, sea radish. R. raphanistrum, yellow white lilac, jointed charlock, cornfields (*see* charlock).

III. *Angustiseptæ.*—Silicle laterally compressed, opening with two boat-shaped valves, or winged on back, dissepiment narrow linear or lanceolate, cotyl. accumbent or incumbent.

Capsella bursa-pastoris, shepherd's purse (many seeded). Thlaspi, penny-cress, more than two seeds in cell. T. arvense, white, pouch large orbicular, with broad longitud. wing. Iberis amara, bitter candytuft, petals unequal. Lepidium campestre, pouch ovate, scaly, style scarcely longer than notch, seeds one in each cell. Senebiera* coronopus, wart-cress, whole plant prostrate, easily passed over in grassy places, pouch subreniform, in dense clusters, cells 1-seeded. Hutchinsia petræa, Teesdalia nudicaulis, are inconspicuous plants (2—4 inches). H. petræa, pouch entire, valves boat-shaped, keeled not winged at back, cells 2-seeded. T. nud., pouch emarginate, keeled, winged above, fil. with remarkable scale at base. Subularia aquatica, leaves subulate, flowers often perfected under water.

IV. *Latiseptæ.*—Silicle oval, not dividing transversely, opening with two valves, dissep. in broadest diameter, cotyl. mostly accumbent.

Cochlearia armoracia vel A. rusticana, horseradish. Draba, whitlow grass, seeds in two rows, many in cell. D. verna, walls, scape leafless, petals partite. Cochlearia, scurvy-grass, valves very convex, dorsal vein prominent, seeds many. C. officinalis, stem leaves sessile, pouch obovoid, style short. Armoracia, valves convex, no vein. Alyssum calycinum, yellow becoming white, 2—4 seeds in cell, shorter fil. with subulate processes on base. Koniga maritima, white, fil. simple, glands hypogynous.

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* Cotyl. easily examined.

v. *Siliquosæ.*—Pod a siliqua, not dividing transversely, dissepiments necessarily narrow, but in broadest diameter, cotyl. accumbent or incumbent, conduplicate in Brassica, Sinapis, and Diplotaxis.

Matthiola, stock, Cheiranthus cheiri, wallflower, have a 2-lobed stigma. Hesperis matronalis, dames' violet, large lilac, fragrant, stigma of two closely converging erect lobes, stigma in other genera a disk. Dentaria bulbifera, coralwort, rare, axillary bulbs, rose coloured or purple, seedstalk winged. Alliaria, Sisymbrium, Erysimum, have stigmas with thickened edges. Alliaria officinalis, Jack-by-the-hedge, very common, white, sepals loose, equal at base, seedstalk flattened and winged. S. thalianum, white, pod angular (in other Sis. terete), with one strong mid-rib. S. officinarum, hedge mustard, common, pale yellow small, pods subulate adpressed to stem, plant often purplish on exposed sides, very hardy. S. irio, London rocket, yellow, pod 4 times pedicel, erect, patent, l. runcinate pinnatifid. S. Sophia, fluxweed, yellow, pod 3 times pedicel, l. bi- or tri-pinnatifid. Erysimum cheiranthoïdes, wormseed, yellow, common in places, tetragonal pod (valves keeled) diverging from stem, crammed with small seed. Brassica, l. glabrous glaucous, calyx erect knobbed, siliqua horned, seeds globose. B. oleracea, wild cabbage, cream coloured, upp. l. oblong sessile. B. campestris, wild turnip, yellow, l. lyrate dentate, somewhat hispid, upper ovate acuminate, deeply cordate, amplexicaul, glabrous. B. napus, cole seed, yellow, scarcely distinguished from campestris, low. leaves glabrous, upp. oblong, narrowed below with dilated, cordate, amplexicaul base (these have 1-ribbed valves). Cardamine, bitter cress, valves of compressed linear pod veinless, rolling up in opening. C. pratensis, lady's smock, large lilac, anthers yellow. C. amara, large white, anthers purple. C. hirsuta, small white, stamens 4. C. impatiens, auricles at base of petioles. C sylvatica, wavy stem, stam. 6, style long. Arabis, rockcress, calyx gibbous, siliqua linear pedunculated, stigma sessile, seeds in one row. A. hirsuta, stem leaves truncate auricled or cordate at base. Barbarea, rocket, l. glabrous, flowers in yellow bunches (May), valves convex-keeled, making pod appear subtetragonal, seeds in one row. Sinapis, l. scabrous, cal. spreading in flower, pod subterete beaked, fl. yellow. S. nigra, pod subquadrangular, beak subulate, almost wanting, seed small, blackish brown. S. alba, pods cylindrical, knotted, shorter than ensiform beak, seed large yellowish. S. arvensis, charlock, like alba, pod longer than the conical compressed beak. The remaining genera have their seeds in two rows. Turritis glabra, whitish yellow, plant very erect (1—3 ft.), pod compressed, erect, straight, valves with longitudinal rib. Diplotaxis, wall mustard, calyx patent, pod compressed, seeds ovoid or oblong, plants a few inches high. D. tenuifolia, large yellow, stem woody below, branched subglabrous purplish, corolla twice the length of calyx, pod and pairs of seed oblique. D. muralis, simple herbaceous stem. Nasturtium, pod subcylindrical, valves convex, veinless, seeds irregularly in two rows, calyx patent, petals entire, wet places, often many plants together. N. officinale, watercress, white, leaves pinnate. N.

sylvestre, yellow, petals twice as long as calyx. N. palustre vel terrestre, rather common, yellow, root fibrous, spreading, petals not longer than calyx, pod oblong, thick.

Note.—Cochlearia offic., scurvy-grass. C. armor. Sinapis nigra. S. alba. The Caper order is closely allied to the Cruciferæ.

POLYPETALÆ.—B.

Hypopetalous, thalamifloral, plac. axile, free central, or on ventral suture of simple pistils.

Magnoliaceæ.—Exotic (but cultivated) trees or shrubs, fl. trimerous, carpels separate (*see* Ranunculaceæ).

Note.—Illicium anisatum, star anise. Drimys Winteri, winter's bark.

Menispermaceæ.—Tropical woody climbers, sepals and petals alike, carpels distinct (related to Berberidaceæ), diœcious, rarely perfect.

Note.—Cissampelos pareira, pareira-brava. Anamirta cocculus, cocculus berries (drupaceous). Cocculus palmatus or Jateorrhiza calumba, calumba. The Myristicaceæ, nutmegs, are allied to this order.

Aurantiaceæ.—Exotic (but cultivated), l. artic., smooth glandular, calyx monophyllous, style simple, seeds exalbuminous, often multi-embryonic.

Citrus, cal. persistent, pet. 4—5 caduc. ft. of 5—20 polyspermous cells.

Note.—C. aurantium, sweet orange. C. bigaradia vel vulg., Seville orange. C. bergamia, bergamot. C. limetta, sweet lime. C. limonum, lemon. C. lumia, sweet lemon. C. medica, citron. Ægle marmelos, bael. Orange flowers, neroli; orange rind, ess. portugal; oranges (small ones and leaves?) petit grain.

Vitaceæ.—Sarmentous, cirrhose, seeds osseous.

Ex.: Vitis vinifera, vine. Ampelopsis (var.), Virginian creepers.

Aceraceæ.—Trees with opp. leaves, fl. in cymes or bunches.

Acer campestre, maple. A. pseudoplatanus, sycamore. Examine the Phyllolobeæ or leafy cotyledons.

Note.—Æsculus hippocastanum, horse chestnut.* Paullinia sorbilis, guarana. (These plants properly belong to a distinct order, "Sapindaceæ.") Erythroxylon coca (Erythroxylaceæ), temporary succedaneum for food (not cocoa, *see* Byttneriaceæ).

Hypericaceæ. — Leaves opposite, dotted, exstipulate, petals oblique or convolute in æstiv., stam. polyadelphous.

Ex.: The tutsans, or St. John's worts, yellow and tinted. Closely allied to this order are others. Guttiferæ, or gamboge order. Dipteraceæ, containing Dryobalanops camphora, Borneo camphor; Shorea robusta, dammar pitch; Valeria indica, gum animi or copal. Cammelliaceæ, containing Thea chin., tea.

Rutaceæ.—Leaves compound, exstipulate, dotted with glands, seed inverted.

Ruta, reg. 8—10 pores at base of ovary. Ruta graveolens, rue. Dictamnus fraxinella, gardens.

Note.—Galipea cusparia, Cusparia or angustura bark. Barosma, buchu. B. bet., ovate and obovate. B. serr., linear lanceolate. B. cren., ovate, oblong, obtuse.

Tiliaceæ.—Malvaceous, stam. either free or polyadelphous, anth. bilocular, styles united into one, embryo in axis of albumen.

Ex.: Tilia, lindens.

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* Dehis. loculicidal, but appearing septicidal.

Polygalaceæ.—Sepals, 3 ext., 2 int. petaloid, stam., subdiadelphous.

Polygala vulgaris, prostrate, whitish, common on heaths, somewhat the appearance of a violet.

Note.—Krameria triandra, rhatany. Polygala senega, snake-root.

Berberidaceæ.—Floral whorls apparently opp. anthers with valve dehis., plac. basal.

Ex.: Berberis vulg., yellow, 6.6.6., stam. irritable. Epimedium alpinum, barren wort, 4.4.4, capsule pod-like.

Malvaceæ.—Calyx valvate, petals simple, stamens numerous monadelphous, columnar, anthers one-celled with transverse dehiscence, seed often cottony exalbuminous. Indigenous plants have a quinquepartite calyx, and a ring of carpels. The three genera may be distinguished by the number of segments in involucre or epicalyx.

Lavatera arborea, tree mallow, rare, maritime, epic. trilobate. Althæa officinalis, marsh mallow, epic. 6—9 cleft. Malva, epic. of 3 leaves. M. moschata, l. subreniform, lobes bipinnatifid 5—7. M. sylvestris, common mallow, erect, l. reniform, lobes crenate 5—7, ft. glabrous, reticulate, rugose. M. rotundifolia, decumbent, outer sepals shorter than the stellately hairy inner ones. The Byttneriaceæ, chocolates, are closely allied.

Note.—Gossypium herbaceum, &c., cotton. Hibischus abelmoschus, grain musk.

Simarubaceæ.—Rutaceous, exotic.

Ex.: Picræna excelsa, quassia.

Caryophyllaceæ.—L. opp., undivided, rarely stipulate, tumid nodes, placentaries often becoming free central, cor. white or pinkish. Order affords examples of chorisis or deduplication. Form of corolla alsinaceous (very distinct) or caryophyllaceous (claws long, petals regular and distinct).

Calyx tubular, 5-toothed, petals clawed, capsules stalked, examples rare.—Dianthus, pink, styles 2, scales at base of calyx; Saponaria offic. soapwort, pale pink, styles 2, petals with coronet, seeds globose or reniform; Cucubalus bacciferus, styles 3, berry globose, 1-celled. Silene, calyx often inflated, styles 3, cap. opening at top with six valves. S. inflata, bladder campion, bracts scarious. Lychnis, styles 5 cap. opening at top, 5—10 teeth. L. floscuculi, ragged robin, rose coloured petals deeply 4 cleft, carpophore short. L. githago, corn cockle (Agrostemma), calyx lobes far exceeding corolla.

Sepals free, stamens inserted in hypogynous ring, petals scarcely clawed, valves of capsule equal in number to styles, mostly rare.—Honkeneja, Alsine, Cherleria, Sagina. Sag. apetala, S. procumbens, are mosslike plants, often apetalous, growing along garden walls. The following have bifid valves, or valves twice as many as styles—Holosteum (umbellatum), styles 3, petals 5, jagged at end; Malachium (aquaticum), styles 5, valves 5 bifid; Moenchia (erecta), petals entire, sep. pet., stam., 4. Of these others again are quinquepetalous:—Arenaria, some common, petals entire, caps. opening with 3 bidentate valves; Cerastium, some common, petals bifid, styles 5, capsules opening with 10 teeth; Stellaria, stitchwort and chickweed, petals bifid, stam 10, styles 3, caps. many seeded, valves 6. S. media, var., chickweed. S. holostea, greater stitchwort, large white flowers in hedge-rows early in year, l. sessile, lanceolate attenuate. S. glauca, l. sessile smooth, bracts with scarious glabrous margins. S. graminea, bracts scarious, ciliate. S. nemorum, seeds on long columella. Three genera have stipules which are scarious, sep. distinct, &c., as in others. Polycarpon, pet. 5 emarg. P. tetraphyllum, rare. Spergula,* calyx with 5 obtuse divisions, petals entire, caps. 5—3, valved opp. sepals, many seeded. S. arvensis, spurry, common, l. linear, convex above, furrowed beneath. Lepigonum, sand spurry, valves fewer than or alternate with sepals. L. rubrum is found inland; others on the sea coast. Scleranthеæ, Knapwells: These are unlike the other plants of this order, the petals are absent, and the sepals are connate, forming a hardened tube enclosing the 1-seeded capsule, flowers frequently solitary and green in the forks of the stem.

Ranunculaceæ.—Fl. whorls divided; l. alternate compound sheathing, sep. 3—5 caducous; pet. 0—9, æstiv. imbricate; St. numerous, adnate, extrorse; ovary, uni- or multi-ovular, surmounted by style; ft. monospermous indehiscent or polyspermous dehiscent, albumen horny. Actæa and Pæonia have introrse anthers. Clematis has opposite leaves, valvate æstivation (of calyx), and caudate feathery styles.

1. *Calyx and corolla present, capsules or follicles multiovular* (*Caltha cor. O.*)

Actæa, sep. petaloid, pet. minute, 4, carp. baccate: A. spicata, baneberry. Pæonia, sep. pet. 5, follicles 2—5, ventral dehiscence. Aquilegia, pet. 5, infundibuliform, horn-like spur. A. vulgaris, columbine. Nigella, pet. nectariferous, fol. 5—10, united at base (gardens). Trollius, pet. small ligulate: T. europæus, yellow, globe flower. Eranthis, pet. small, tubular bilabiate, follicles stalked: E. hyemalis, yellow, winter aconite.

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* Spurries often found in unlikely situations, seeds being transported in straw, &c.

Helleborus, pet. small tubular clawed, follicles sessile 3—10: H. niger, Christmas rose, gardens, sepals white pinkish, l. pedate, lobes 7—9, oblong lanceolate. H. fœtidus, setterwort, 2 feet, l. pedate, calyx converging, fl. greenish purple. H. viridis, radical leaves digitate, calyx spreading. Aconitum, two upp. pet. tubular on long stalks concealed in cassideous or galeate sepal; A. napellus, aconite. Delphinium, upp. sepal with long spur, two upper petals spurred, foll. free: D. ajacis, larkspur. Caltha palustris, large yellow, marsh marigold.

2. *Calyx and corolla, ovary of one ovule, ft. an achænium.**

Adonis; leaves finely cut, pet. 5—10, no awn to style: H. autumnalis, pheasant's eye, scarlet, rare. Myosurus, stam. 5, carpels closely imbricated on filiform receptac: M. minimus, mousetail. Ranunculus, carpels in globular mass, pet. 5—9, scale at base. Those with transversely wrinkled laterally attached carpels, often aquatic; pet. white with yellow claw are rather rare. There is one example of a basally attached transversely wrinkled carpel, R. sceleratus, celery-leaved crowfoot, very common in ditches, petals small yellow, head of fruit oblong. Others with carpels basally attached and yellow flowers are R. arvensis, corn crowfoot, divided leaves, beaked and spinous fruit and (among those with divided leaves) the buttercups, viz., R. bulbosus, stem corm-like, peduncles furrowed, calyx reflexed; R. repens, creeping crowfoot, peduncles furrowed, calyx erect patent; R. acris, upright crowfoot, peduncles round, calyx erect patent. Having nearly entire leaves are R. ficaria, lesser celandine or pile-wort, root fasciculate, l. cordate stalked, and the following, which have also nearly parallel veins:—R. flammula, lesser spearwort, stem reclining, at base rooting, l. stalked, carpel pitted and pointed; R. lingua, great spearwort, rather rare, stem erect, l. sessile, carpel pitted, with a broad ensiform beak.

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* *i.e.* each pistil an achænium, ft. an etærio.

3. *Calyx only, ovary of one ovule, ft. an achænium, seed pendulous.*

Clematis, l. opp. perianth 4—5, achænium surmounted by feathery point: C. vitalba, travellers' joy. Anemone, involucre of three leaves distant from flower: A. pulsatilla, pasque flower, violet purple, carp. with feathery tails. A. nemorosa, white purplish, carp. keeled, not tailed. Thalictrum (var.), meadow rue. T. flavum, common meadow rue: many of these are several feet high.

Note.—Delphinium staphisagria, stavesacre. Podophyllum peltatum, podophyllon. (Hellebores, *see also* Melanth.) Hydrastis canadensis, yellow puccoon. Xanthorhiza apiifolia, Am. yellow root (both tonics, Amer).

Geranaiceæ.—Cal. 5, cor. 5, st. 5—10, stigmas or styles 3—5, often irregular, monadelphous, ft. capsular, 5-celled, or 3—5 achænia adherent to carpophore, dehis. elastic.

Geranium, cranesbill, decandrous, beak glabrous internally. G. robertianum, root fusiform, peduncle 2 fl., pinkish, carpels transversely wrinkled. Erodium, storksbill, decandrous, 5 sterile, beak bearded; few examples. Pelargonium, heptandrous, beak barbed internally, gardens.

The remaining genera have mostly exstipulate leaves, and have been raised to the rank of orders. Tropæolum, garden nasturtiums, fruit of three exalbuminous achænia. T. peregrinum, canary creeper. Balsamineum, allied to geranium, succulent, flower more irregular, carpophore and style absent. Impatiens noli-me-tangere, yellow balsam, rare. Oxalis, allied to geranium, leaves compound (ternate), styles 5, distinct, caps. 5-celled polysperm. O. acetosella, wood sorrel, white purplish. O. corniculata, yellow, local, gardens. Linum, flax, 5-5-5-5, caps. 5-celled, each divided by false septum. L. usitatissimum, blue, stem solitary, sepals ovate. L. angustifolium, blue, stems many, sepals elliptic. L. catharticum, dry places, from its white petals and opposite leaves may be mistaken for a chickweed. Radiola linoïdes, white, 4-4-4-4.

POLYPETALÆ.—C.

Peripetalous, calycifloral.

Of these Cucurbitaceæ and some Saxifragaceæ have parietal placentaries, others axile or ventral. (For other calycifloral orders see epigynous gamopetalous flowers.)

Cucurbitaceæ.—Climbing plants, yellow or green, monœcious or diœcious, ft. fleshy.

Bryonia dioïca, ft. red; B. alba, ft. black. The ovules in Cucumis, cucumber, Cucurbita, melons and pumpkins, Bryonia, Citrullus, Ecbalium, are horizontal, in some genera erect, in others solitary and pendulous.

Note.—Citrullus colocynthis, colocynth. Ecbalium officinarium, elaterium.

Saxifragaceæ.—Ov. sup. or more or less inf. unilocular, plac. 2 parietal, sometimes uniting in centre, white, yellow, ft. capsular.

Saxifraga 5. 5. 10—5. 2, caps. 2-celled. S. umbrosa, London pride, has decumbent barren shoots at base, others are mostly Irish or Scotch. Two others without barren shoots at base leafy and a few inches high are found on dry banks—S. tridactylites, viscid, peduncles 1 fl. with two bracts at base; S. granulata, roots tuberculous, rad. leaves reniform, calyx half superior. Chrysosplenium, golden saxifrage, damp places, 4. 0. 8—10. 2, cap. 1-celled. C. alternifolium. C. oppositifolium. Parnassia palustris, 5 inf. 5. 5 perig., scales 5, interposed, cap. 1-celled, valves 4, bogs in North. Hydrangea. Deutzia. Philadelphus coronarius or Syringa.

Grossulariaceæ.—Saxifragal characters, fruit baccate.

Ribes grossularia, gooseberry, stem spinous, ped. 1—3 fl. R. nigrum. R. rubrum, currants, no spines, fl. in racemes.

Portulaceæ.—Caryophyllaceous, 2.5—0.5 opp. petals, fewer or more.

Montia fontana, cor. 5 parted 3, seg. smaller, triandrous. Claytonia perfoliata, cor. 5, free, pentandrous, style 3-cleft.

Paronychiaceæ.—Caryophyllaceous degenerate, *vide* Scleranthus, Spergula, Polycarpon. Petals minute.

Corrigiola littoralis, strapwort, sandyshores, l. alt., pet. 5, oblong, stigmas 3. Herniaria, rupture wort, pet. 5 filiform, stigmas 2.

Crassulaceæ.—Sepals, petals, ovaries, equal in number, often gamopetalous, l. fleshy.

Tillæa muscosa, l. opp., pet. white tipped with red, ess. and env. 3—4. Cotyledon, navel wort, 3 hypog. scales, corol. tubular, 5.5.10.5. C. umbilicus, greenish yellow. Sempervivum tectorum, houseleek, hyp. scales lacinate, 6—10.6—10, st. double number. Sedum, stonecrop, yellow, white, purple, stam. double number of calyx seg. 5.5., rarely 4—7. S. acre, wall pepper, yellow, l. blunt, sep. blunt gibbous. Crassula 5.5.5.5 generally.

Lythraceæ.—Exstipulate, free fruit surrounded by calyx, 2 or more seeded, cor. 4—6, st. *eq.* or *dble.*

Lythrum, cal. tubular cyl., style filiform. L. salicaria, purple loosestrife, l. opp. cordate lanceolate (compare with Stachys). L. hyssopifolia, l. alt. linear lanceolate, bracts 2, minute. Peplis portula, water purslane, calyx campanulate, l. opp., petals often 0, style short, caps. opening irregularly, plant 4—6 inch. Ceratophyllum: Horn wort (Ceratophyllaceæ) monœcious, anth. 12—20, per. 0, cotyledons 4 (see Coniferæ).

Terebinthaceæ or *Anacardiaceæ.*—Sumach order (not turpentine, *see* Coniferæ). Trees, with alternate leaves and milky juice, calyx multi-gamosepalous, petals 3—5—0, stamens same number as petals. carpels 3—5, unilocular, uniovular, ft. dry or fleshy, seed exalbuminous. Tropical plants. Order broken up into several others, as Burseraceæ, Connaraceæ, Anacardiaceæ.

Pistacia vera, pistachio nut. P. terebinthus, chia turpentine. P. lentiscus, mastiche. Rhus toxicodendron, poison oak (N. Amer.). R. cotinus, shrubberies, fustic. Boswellia thurifera, Indian olibanum. B. floribunda, African olibanum. Anacardium occidentale, cashew nut. Balsamodendron myrrha, myrrh: B. opobalsamum and B. gileadense, balm of Mecca. B. mukul, bdellium. Canarium commune, E. Indian elemi. Elaphrium elemiferum, Mexican elemi. Icica icicariba, Brazilian elemi, Mangifera indica, mango.

Rhamnaceæ.—Trees or shrubs, exstipulate, 4—5.4—5. 4—5.1, ft. caps. or drupaceous, many monospermous cells.

Rhamnus, cal. valv. in bud, stam. opp. petals. R. catharticus, branches opposite, l. roundish, oval, sharply toothed, fl. 4-cleft diœcious, styles

4. R. frangula, branches alternate, l. elliptical entire, fl. 5-cleft. Ilex aquifolium, holly (Aquifoliaceæ). Euonymus europæus, spindle tree, (Celastraceæ).

Onagraceæ.—Evening primrose and fuchsia order. Ov. infer., fl. whorls a multiple of 2.

Isnardia 4.4.0.4, cap. 4-cell, 4-valv. I. palustris, local. Œnothera, evening primrose, yellow, octandrous, seeds naked. Circæa, enchanters' night, shade, 2.2.2., caps. 1—2 celled. Epilobium-willow herbs, rose coloured; two have scattered leaves, irreg. fl., calyx without a free tube, and stamens and styles declining. E. angustifolium, rose bay, l. lanceolate veined. E. rosmarinifolium, mountains, dwarf plant, l. linear not veined. The great willow herb, with clasping leaves acute below, is common in ditches. Myriophyllum, water milfoil (Haloragaceæ), monœcious, 4.4.8.4, fruit tetragonal, 4-celled, monospermous.

Euphorbiaceæ.—Fl. unisexual, ft. tricoccous, dissilient, separating when ripe on inner edge, seed often scrobiculate (pitted), ovary often on gynophore (stalk).

Mercurialis, l. opp. (monœ or diœ.), perianth, 3-parted, stam. 9—16; female, 2 barren filaments, style short, cap. 2-celled, 1-seeded. M. perennis, M. annua (compare Circæa). Buxus, no milky juice, monœcious. B. sempervirens, box (Buxaceæ). Ricinus (gardens), monœcious regular, ovary globular, 3-celled, stigmas 6, coloured and feathery, capsule often spinous. Euphorbia, fl. collected into heads, consisting of one female and many male flowers, ovary pedicellated, style 3, bifurcate. (Do not mistake inflorescence for simple flower, each stamen with bract represents a male flower.) E. lathyris, garden caper spurge,

l. opp. E. amygdaloides, wood spurge, bracts rounded, connate. E. peplus, petty spurge, very common, l. stalked, broadly ovate. E. exigua, l. linear blunt, common bracts lanceolate; plant a few inches high, not so herbaceous as peplus. E. helioscopia, sun spurge, bracts and leaves membranous, obovate, cuneate, serrate upwards. E. platyphylla, fields, stam. 7—8 in each involucre, caps. with shortly conical tubercles, seed stalk reniform. Other species are more or less rare. E. paralias, sea spurge, l. oblong coriaceous. E. peplis, l. stipulate, sea coast.

Note.—Croton eleuteria, cascarilla. Croton tiglium, croton oil. Ricinus communis, castor oil (often small spec. cultivated). Jatropha manihot, tapioca. Euphorbium canariense et var., euphorbium. Rottlera tinctoria, kamala. Siphonia elastica, caoutchoucs (Ficus elastica also yields caoutchouc). Jatropha curcas, physic nut.

Rosaceæ.—Leaves alternate stipulate, corolla rosaceous or absent, carpels enclosed within or situated upon thalamus; stamens icosandrous, rarely few, odd lobe of calyx posterior, petals fugacious not glossy, white, pinkish; many are (yellow) herbs. The sub-order Roseæ has adnate stipules. The Chrysobalaneæ differ from the Drupaceæ, chiefly by their adherent carpel, basilar style, and erect seed.

Sub-Orders.

I. *Drupaceæ.*—Carpel 1, free, fruit a drupe, seed suspended (white flowers). Trees or shrubs.

Prunus communis (var.), sloe, bullace, plum, &c. P. padus, bird cherry, rac. pend., white. P. avium, wild cherry, umbels, l. drooping incisoserrate, downy beneath, calyx tube constricted below sepals.

P. cerasus, dwarf cherry, umbels, l. not drooping, doubly crenate, serrate, glabrous, calyx tube not constricted. P. lauro-cerasus, axillary racemes l. evergreen coriaceous, remotely serrulate, shining above, drupe round and black, destitute of bloom (shrubberies). Cerasus lusitanica, Portugal laurel (shrubberies). Amygdalus communis, almond. A. persica, peach. Prunus armeniaca, apricot. Chrysobalanea icaco, cocoa plum, W. Indies.

II. *Pomeæ.*—Ovary infer., calyx tube adherent to 1—5 carpels, forming a melonoid or pome, white or tinted flower. Trees or shrubs.

Mespilus germanica, medlar. Cydonia vulgaris, quince. Cratægus oxyacantha, hawthorn. Cotoneaster vulgaris, nuts adhering to calyx, but not cohering in centre. Pyrus, pear, styles distinct, apex of fruit umbilical. P. malus,* crab, styles combined, base and apex of fruit umbilical. P. communis, styles distinct, fruit turbinate. P. aucuparia, rowan tree or mountain ash, berries red globose, fl. corymbose, small tree very common in gardens. P. torminalis, wild service tree, l. ovate lobed, lobes triangular acute, fruit brown.

III. *Roseæ.*—Stipules adnate, carpels several, distinct from each other and from the calyx, shrubs or herbs, white, tinted, or yellow.

a. Rosideæ, calyx tube fleshy, enclosing many achenia: Rosa. *b.* Sanguisorbidæ, calyx tube dry, enclosing 1—3 achenia: Sanguisorba, Poterium, Agrimonia, Alchemilla. *c.* Potentillidæ, calyx tube herbaceous, receptacle dry or succulent, fruit many, seed-like, inserted on receptacle, forming an etærio: Potentilla, Sibbaldia, Comarum, Fragaria, Rubus,

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* **Make out the ascending seeds in an apple; characteristic of the Pomeæ.**

Dryas, Geum. *d.* Spiræidæ, calyx tube herbaceous, follicles several: Spiræa.

Rosa.—Shoots setose, prickles scarcely curved; mostly Irish or Scotch forms. Bedeguars or beard-like excrescences frequently found on plants of this genus. The sweetbriar and a few other forms with leaves glandular beneath, are rather common. The Caninæ have shoots or branches mostly without setæ, prickles uniform scattered, styles nearly enclosed in calyx tube. There are about six forms of R. canina, and two frequently met with having united styles projecting beyond tube.

Sanguisorba officinalis, great burnet, fl. perfect 4.0.4, nuts 1—2. Poterium sanguisorba, lesser burnet, 4.0.1.2—20, monœcious, nuts 2—3, in quadrangular wrinkled calyx tube. Agrimonia eupatoria, 5.5. 12—20, nuts 1—3, calyx tube turbinate, armed with hooked bristles, stem racemose, corolla rosaceous, yellow. Alchemilla, greenish, stam. opp., smaller segments of calyx, 8.0.1—4. A vulgaris, lady's mantle, l. reniform 7—9 lobed. A. arvensis, parsley piert, l. cuneate, palmate, trifid. Sibbaldia procumbens, Scotch mountains, calyx concave, segments in two series 10.5.5, nuts 5—10.

Potentilla, calyx in two series, stam. indefinite, many small nuts on flattish dry receptacle, 8—10.4—5, mostly yellow. P. rupestris, white, Wales, local, P. anserina, yellow, very common, are the only ones with pinnate leaves; those of the others are digitate. P. fragariastrum, barren strawberry, white, only common specimen of a potentilla with hairy carpels and long hair on receptacle. The following species have hairs of the receptacle shorter than the glabrous carpels. P. argentea, stem

ascending, leaves quinate, white and downy beneath. P. verna, stem prostrate, leaflets obovate, lowest stipules narrowly linear. P. reptans, stem prostrate, rooty, l. quinate stalked, carpels asperous. P. tormentilla, small yellow, l. leaves quinate, others ternate, carpels longitudinally wrinkled. Comarum palustre, marsh cinquefoil, purple, receptacle spongy, enlarged. Fragaria vesca, strawberry; receptacle large, pulpy, deciduous. Rubus, bramble, 5.5, small succulent drupes (acini) on conical receptacle. R. chamœmorus, cloudberry, rare, receptacle nearly flat, ft. orange coloured. R. idæus, raspberry; R. (var.), blackberry; R. cæsius, dewberry. About fifty other species.

Geum and Dryas differ from other Potentillidæ by their inferior radicle and awn-like styles. Geum, calyx 10-cleft, in two rows; styles geniculate, hooked at knee. G. urbanum, avens, small yellow, 2 ft. high, erect; hedges and wet places. G. rivale, pinkish or purplish, carpophore grows long after flowering, lower joint of style equalling upper joint. Dryas octopetala, white, calyx 8—10 segments in one row, styles not jointed.

Spiræa ulmaria, meadow sweet, white fragrant, 2—3 feet high, follicles often twisted, handlike, leaflets ovate undivided, the terminal one larger, palmately lobed. S. filipendula, yellowish white and reddish, leaflets all oblong, deeply cut and serrate.

Note.—Potentilla tormentilla, tormentil. Rosa canina, hips. R. gallica, confection. R. centifolia, water, &c. Brayera anthelmintica, cusso. Cydonium vulgaris, quince. Amygdalus communis dulcis, sweet almonds. A. comm. amar., bitter almond. Prunus domestica, prunes. Prunus lauro-cerasus, cherry laurel.

Leguminosæ.—Calyx of 5 segments, odd one anterior;

corolla papilionaceous in our plants, regular in many others; stamens 10, rarely 5 or indefinite, diadelphous, monadelphous, or distinct; pistil free, becoming a legume, lomentum, or drupe; leaves mostly alternate and stipulate. Papilionaceæ.—Corolla papilionaceous, æstiv. imbricate, odd petal posterior and exterior. Cœsalpinieæ.—Corolla wanting or irregular, æstiv. imbricate, odd petal inside the lateral ones. Mimosæ.—Corolla valvate in æstiv., stamens hypogynous.

Papilionaceæ.—5 petals, *i.e.* 1 vexillum, 2 aleæ, 2 carina; 5 sepals, odd one anterior.

Monadelphous, mostly yellow.

Leaflets solitary : Ulex, furze, disep. upper 2, lower 3, minute teeth, pod thick. Genista, calyx bilab., upper bifid, lower 3-toothed. *Leaves trifoliate :* Sarothamnus, calyx bilabiate, upper with 2, lower with 3 teeth, pod flat. Ononis, calyx 5 cleft. *Leaves imparipinnate :* Anthyllis vulneraria, lady's finger, yellow, known at once by its pair of capitulate flowers, digitate bract and satiny inflated calyx, stamens sometimes imperfectly diadelphous.

U. europæus, fl. lateral, bracts lax ovate, cal. shaggy. U. nanus, l. glabrous, spines terete, striate, smooth, bracts minute adpressed, calyx finely downy. U. galii, orange coloured, aleæ longer than carina. G. anglica, needle whin, stem spinous, leafless below, fl. small solitary. G. pilosa, stip. ovate blunt, peduncles accompanied by tuft of leaves, pods pilose. G. tinctoria, dyers' weed, racemose, stip. minute subulate. Last two forms mostly destitute of spines, rare. O. arvensis, O. spinosa, rest-harrow, shrubby plants, pale lilac flowers. Sarothamnus scoparius, broom, yellow, calyx 2-lipped, the upper with 2, and the lower with 3 teeth.

Diadelphous, yellow, purple, white.

Leaves trifoliate, cal. nearly equally 5-toothed: Trifolium (var.), clover, cal. teeth rather unequal, fl. almost capitulate, petals persistent, cohering and adhering by claw to filaments which are enlarged upwards. Melilotus alba et M. officinal. (flava) flowers in loose racemes, ovary straight. Falcatula ornithopodioïdes, rare, petals decid., distinct from one another and from filiform filament, clusters stalked. Medicago, often yellow, and nearly capitulate, ovaries falcate or helicoid. Lotus, inflor. sub-umbellate, carina running up into beak, pods many seeded, with imperfect transverse partitions. *Leaves imparipinnate, Ir. Scotch or rare, pods imperfectly 2 celled:* Astragalus, keel blunt, cells from lower suture. Oxytropis, keel straight pointed, cells from upp. suture. *Leaves imparipinnate, fruit a lomentum:* Onobrychis sativa, sainfoin, crimson racemes, cultivated. Hippocrepis comosa, yellow, horse-shoe vetch, known and named from fruit. Arthrolobium ebracteatum, yellow, vexillum red, Chan. Is., ft. scarcely narrowed at joinings. Ornithopus perpusillus, bird's foot, white, crimson veins, a few inches high, ft. narrowed at joinings. *Leaves paripinnate:* Vicia, tubes of stamens obliquely truncate, style filiform, upper part equally hairy in the tares, bearded on under side in the vetches, style making angle with ovary. Lathyrus, rachis terminated by tendril, tube of stamen transversely truncate, style flattened upwards, hairy beneath stigma.

Medicago sativa, Lucerne, violet or yellow, cultivated. M. falcata, yellow medick, falcate pods. M. lupulina, small yellow heads, pods reniform, turning black. M. sylvestris, yellowish, pod forming complete flat ring. M. maculata, peduncles 1—4 fl., fruit compactly spiral with 4 ridges on edge, and central furrow edged with spines. M. minima, rare, pod compactly spiral, edged with spines, edge smooth and thin. M. denticulata, pod deeply netted, edge like minima.

Lotus corniculatus, common, habit variable, calyx teeth straight in bud, upper ones converging. L. major, common, ascending, calyx teeth stellate in bud, two upper ones diverging.

Lathyrus aphaca, yellow, stipules very large and leaf-like, petioles forming tendrils, no true leaflets. L. nissolia, purple flowers on long stalks, stipules minute, petioles leaf-like, without tendrils or leaflets. Grass-like plant, soon withering, flowering period short: must be carefully sought for late in May, pods a few inches long. L. pratensis, yellow, common, stem angular, peduncles many flowered, one pair of leaflets and a tendril. L. palustris, bluish purple, and L. maritimus, sea pea, have two or more pairs of leaflets and a tendril. Two others (orobus) are rare, having pinnate leaves and no tendrils.

Vicia lathyroïdes, purple small, style bearded below stigma, calyx not gibbous, seed cubical, tuberculated. (3—5 in.) V. cracca, long almost circinate racemes of bluish flowers, style scarcely bearded, calyx gibbous, stipules half arrow shaped, entire. The following have bearded styles and calyx gibbous on upper side :—V. sativa, common vetch, fl. axillary, solitary or in pairs, calyx teeth equal, pods linear silky. V. sepium, fl. 4—6, axillary subsessile clusters, calyx teeth unequal. V. bithynica, purple, often solitary, leaflets of upper leaves in two pairs, elliptic, lanceolate, mucronate, acute, rare.

V. lutea, sulphur coloured, calyx teeth unequal, vexil. glab. V. sylvatica, ped. long, many small cream coloured flowers streaked with blue, calyx gibbous, stipules with setaceous teeth, calyx teeth subulate, shorter than tube. The other genera comprising the tares have few flowered peduncles, calyx not gibbous, style not bearded. V. tetrasperma, smooth tare, small plant, pedunc. 1—2 fl. tiny pale blue, leaflets blunt. V. gracilis, larger than tetrasp., leaflets acute, pod 5—8 seeded. V. hirsuta, hairy tare, ped. 1—6 fl., pod oblong 2-seeded, hile long linear.

Note.—Acacia vera, gum. A. (var.), gums. Astragalus verus, tragacanth. Acacia catechu, black catechu (*see also* Cinch. et Palm). Hæmatoxylon campechianum, logwood. Tamarindus indica (W. Ind.) tamarinds. Cassia fistula, cassia pulp (*see* Laur.). C. (var.), senna. Copaifera (var.), copaiba. Myroxylon pereiræ, peruvian balsam. M. toluifera, tolu. Pterocarpus santalinus, red sandalwood. P. marsupium, kino. Glycyrrhiza glabra, liquorice. Mucuna pruriens, cowhage. Physostigma venenosum, calabar bean. Andira inermis, cabbage tree. Dipteryx odorata, tonquin bean. Cœsalpinia coriaria, divi-divi (twisted legumes). Trigonella fœnum græcum, fœnugreek. Soja hispida, soy. Ceratonia siliqua, carob or algaroba bean. Moringa pterygosperma, ben nuts (Moringaceæ). Aloexylum agallochum, true aloes-wood.

Myrtaceæ.—Tropical (some naturalized), l. usually dotted, and with submarginal vein, fl. rosaceous, mostly axillary, often apetalous. Ft. capsular, Melaleuca. Eucalyptus. Ft. baccate, Punica, Myrtus, Eugenia.

Note.—Melaleuca minor, cajeput. Caryophyllus aromaticus, clove. Eucalyptus globulus, eucalyptus. E. resinifera, Botany Bay kino. Eugenia pimenta, allspice. Punica granatum, pomegranate (Granateæ). Psidium (var.) guavas.

POLYPETALÆ.—D.

Epipetalous,[*] *apparently epigynous, calycifloral by structure.*

Umbelliferæ.—Inflorescence umbellate, whorls 5.5.5.2. fruit, dicypselous. Pericladium, dilated petiole. Stylopod, epigynous disk. Lacinula, inflexed point of petals. Vallecula, interspace between ribs of fruit. Vittæ or stripes, oil tubes of pericarp. Order variously subdivided, *e.g.*:—

1. *Heterosciadiæ.*—Umb. simple, vittæ none. Hydrocotyle. Sanicula. Eryngium.
2. *Haplozygiæ.*—Umb. compound, primary ridges of fruit alone conspicuous. Ammineæ. Seselineæ. Angeliceæ. Peucedaneæ. Scandineæ. Smyrnieæ. Dorema. Ferula. Opoponax.
3. *Diplozygiæ.* — Umb. compound, prim. and sec. ridges of fruit well marked. Daucineæ. Caucalineæ. Coriandreæ. Cuminum.

1. *Orthospermeæ,* alb. flat on commissure. Heterosciadiæ (*see* above). Ammineæ, hemicarp pentag. ridges 5 prominent, comm. as broad as either of other four sides. Seselineæ, as former, but comm. broadest. Angeliceæ, ft. dors. compressed, double wing on each side. Peucedaneæ, ft. dors. comp., single wing on each side thickened towards edge. Daucineæ, ft. dors. comp., secondary ridges, four forming rows of prickles.
2. *Campylospermeæ,* alb. involute, vertical groove on commissure. Caucalineæ, ft. contracted or rounded, lateral prim. ridges on comm., secondary ridges, four more prominent, prickly. Scandineæ, ft. contracted on sides, narrowed or beaked at top,

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[*] Caution, *see* Stamens.

prim. ridges only. Smyrnieæ, ft. ovoid or didymous (halves alike) compressed at sides, not beaked, prim. ridges only.

3. *Cœlospermeæ*, alb. inflexed above and below. Coriandreæ, ft. globose wingless, prim. ridges often inconspic., secondary prominent.

Heterosciadiæ. — Hydrocotyle vulg., pennywort, l. peltate bicrenate, mericarp orbic., marshes. Sanicula europæa, paniculate, white or pinkish, l. palmate. Eryngium marit., blue, sea holly. E. campestre, rare, l. pinnatifid.

Note.—Inflorescence of these plants likely to mislead.

Ammineæ. — Apium graveolens, celery, inv. O., cal. inconspic., pet. entire, marshes. Petroselinum sativ., parsley, walls. Bunium bulbocastanum, B. flex., pignut. Bupleurum rotund., B. tenuis., hare's ear. Egopodium podagaria, 2 feet high, stoloniferous, l. biternate, leaflets uneq. at base, uniting, acutely serrate, stripes O., a troublesome weed in gardens. Sison amomum, 2 feet high, very common, lower l. pinnate, inv. triangular of three spreading leaflets, stripes solitary clavate. Cicuta virosa, water hemlock, rare, 3—4 feet high, l. pinnate, rachis ternate, leaflets variable, ovate lanceolate, acutely serrato-serrulate, acuminate, bases unequal often decurrent (leaves somewhat like those of the rose and of Egop. pod.; no resemblance to dropwort). Trinia vulg., rare, a few inches high, diœcious, l. tripinnate, pet. of bar. fl. lanceolate, of fertile ovate, a single stripe beneath each filiform ridge of ft. Sium angustif. pinnate, leaflets uneq., lobed and cut, umb. lateral, inv. and involucel, ridges blunt, lateral ones not marginal, stylop. shortly con. S. latif., rare, leaflets unequally serrate, lateral ridges marginal, stylop. depressed. Carum, lacinula narrow, stylop. depressed. C. vertic., rare, inv. and involucel of many leaves, segments of leaflets whorled. C. carui, cultivated,

l. bipinn., inv. of one leaf or O., involucel O., val. with single vit. Helosciadium, aquatic. pet. ovate entire, val. with single vit. Pimpinella, inv. and inv. O., pet ovate, clawed, stylop. tumid, ft. ovate, stripes 3 or more together. P. saxifraga, heaths, stem terete, low. leaves roundish, ovate, serrate, upp. leaves bipinnatifid with linear segments. P. magna, stem angular striate, leaflets ovate, serrate.

Seselineæ.—Fœniculum offic., fennel. Crithmum maritimum, samphire, white (*see also* Inula), leaves of inv. lanc., pet. ellip. entire, with broad base, stripes many, seeds free. Haloscias scoticum, lovage, leaves of inv. linear lanceolate, pet. ovate, with short claw, stripes many, seeds free, l. bitern., leaflets rhomboidal. Æthusa cynapium, fool's parsley, common, autumnal, about a foot high, often only a few inches, inv. O., involucel unilateral, far exceeding umbellules, petals white, obcordate with lacinula, ft. ovoid, ridges thick, acutely keeled, three dorsal, two converging around straight central one, two lateral ridges almost winged, vittæ brown* under a small lens, mericarp pale. (Caution: plant supplied from Mitcham for Conium macul. some years ago; ft. intermixed with same sometimes found. Copy of the Con. mac., in a recent French work on pharmacy, has the unilateral involucels and terminal segments of leaflets too strongly marked.) Silaus pratensis, yellowish, sulphur wort, pet. truncate at base. Meum athamanticum, yellowish, pet. acute at both ends. Seseli libanotis, calyx with acute teeth, l. bipinnate, segments lanceolate mucronate, lower ones crossing, inv. of many leaves, ft. hairy, stripes solitary. Œnanthe, dropworts, cal. of 5 lanceolate teeth, petals obcordate, ft. crowned with teeth of calyx and the sub-erect styles; more or less aquatic plants. These two have whorled or fibrous (not tuberous) roots:

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* Dried ripe fruit.

Œ. phellandrium, fine-leaved hemlock, erect, tripinnate, leaflets ovate pinnatifid, submersed leaves multifid with capillary diverging segments, ft. ovate; Œ. fluviatilis, floating, bipinnnate, leaflets often simple, submersed leaves deeply cut at apex, segments cuneate. The others have more or less thickened or fascicled roots. Œ. lachenalii, marshy meadows, leaves few, partial umbels distinct compact and spherical. Œ. silaïfolia, rad. leaves bipin. caul. pinn., leaflets linear acute, stem and petioles hollow, umb. small. Œ. pimpinelloïdes, partial umbels together, forming a compact umbel, ft. with enlarged corky base. Œ. crocata, tubers fusiform, leaflets stalked, roundish, cuneate, lower segment more deeply cut, anthers claret coloured, ft. cylind. (Caution: often mistaken for water hemlock, *i.e.* Cic. vir., really no likeness. The general appearance of the plant is something like that of cow parsnip, but the umbels are more regular; again, the leaves are unlike most other Umbelliferæ.)

Angeliceæ.—Angelica sylvestris, pinkish white, 3 dorsal filiform ridges, 2 lateral at base of wing, stripes solitary, seed adherent to pericarp, taste aromatic bitter. Archangelica officinalis, greenish, ridges thick, stripes O., seeds free, with fine lines (when dry, the pericarp is easily removed), taste aromatic.

Peucedaneæ. — (Caution: although the one lateral wing formed by the combined halves of the fruit may afford a character which distinguishes this tribe from the Angeliceæ under ordinary conditions, yet the student will find in the dried fruit it is only a stronger degree of cohesion, *e.g.* compare fruit of angelica and dill). Pastinaca sativa, parsnip, yellow, pet. roundish, entire, stripes linear, solitary. Heracleum sphondylium, cow parsnip or cow mumble, white, common, leaves large pinnate, outer florets radiant. Peucedanum, yellowish or white, rare, marshes, two lateral ridges at base of dilated margin (wing). Tordylium, reddish, very rare, two lateral ridges close to thick wrinkled margin.

Daucineæ. — Daucus carota, carrot, rad. leaves with oblong narrow outline, segments acute. D. gummifer, rad. leaves with triangular outline, segments blunt mucronate.

Caucalineæ.—Torilis, prim. ridges bristly, val. prickly. T. anthriscus, common, autumnal, involucre of many leaves, prickles not hooked at tip.

Scandineæ.—Scandix pecten veneris, ridges blunt, beak several times longer than fruit, umbels simple, two together, known at once by its remarkably beaked fruit, beaks rather like stalks of umbel.

Anthriscus, ft. narrowed below the short beak, ridges O. A. sylvestris, sheep's parsley, common, vernal, umbels stalked terminal, ft. levigate (smooth). A. vulgaris, umb. stalked lateral, ft. ovate with hooked bristles. A. cerefolium, garden chervil, ft. linear smooth, twice as long as beak, umbels sessile lateral. Chærophyllum temulum, rough chervil, common, later than A. syl., stem purplish, often green at nodes, l. ovate oblong pinnatifid dull olive green, ft. not beaked, ridges blunt, stripes solitary. Myrrhis odorata, sweet cicely, white, aromatic, l. large bipinnate, ft. an inch long, dark brown, pericarp double.

Smyrnieæ.—Physospermum cornubiense, rare, Cornwall, carp. reniform, ridges filiform, slender and equal, lateral ridges within margin, stripes solitary.

Echinophora spinosa, sea shores, rarely found. Smyrnium olusatrum, Alexanders, greenish yellow, rad. leaves large biternate, cal. inconspic., ft. black aromatic, carp. reniform, 3 dorsal prominent sharp ridges, stripes many. Conium maculatum, white, fœtid, stem and petioles glaucous, spotted with purple, involucels unilateral shorter than the umbellules, ridges of fruit wavy crenate (distinguishable without lens).

Coriandreæ.—Coriandrum sativum, white, ft. globose.

Note.—Pimpinella anisum, aniseed (*see also* Magnoliaceæ). Carum carui, caraway. Fœniculum dulce, sweet fennel, Malta (not quite the same as offic. or vulgare). Anethum graveolens, dill. Opoponax chironium, opoponax. Narthex assafœtida, assafœtida. Planta incerta (Peuced.), sagapenum. Dorema ammoniacum, ammoniacum. Hydrocotyle asiatica, used in affections of the skin. Galbanum officinale, galbanum. Cuminum cyminum, cumin (Cumineæ, ft. laterally compressed, ridges apterous). Coriandrum sativum, coriander. Euryangium sumbul, sumbul. Closely allied to the Umbelliferæ is the ivy order, distinguished by the baccate fruit. Panax quinquefolia, ginseng. Aralia nudicaulis, false sarsaparilla.

The Acotyledones or Cryptogamia, including such plants as ferns, fungi, mosses, lichens, and algæ, are not treated of. The student is, however, advised to study structure and peculiarities of ferns, *e.g.* tree ferns. The following plants, illustrating deviations in important characters, should be well studied. Arum mac. Tamus com. Ruscus acul. Lathyrus Nissolia. Tragopogon (var.). Polygonum convol. Scandix pect. ven. Verbascum (var.).

SYNOPSIS OF OFFICIAL PROCESSES.

a. Substances having a definite chemical composition.

Acids.—General process. Saturate acids existing free with lime to form salts; decompose salts by an acid with or without heat: oxidize certain substances.

1. *Existing free.*

Benzoic.—Heat benzoin in a shallow iron pan, benzoic acid sublimes, and may be collected by placing a sheet of bibulous paper, perforated with pin holes, over the pan, and over this a roomy cap of stout paper carefully secured. It is also prepared in a similar way to citric, substituting hydrochloric acid for sulphuric, lime hydrate for carbonate, and decomposing solution instead of precipitate. $HC_7H_5O_2$.

Carbolic.—Obtained from coal tar oil, by fractional distillation, also by the second process for procuring benzoic acid. HC_6H_5O.

Citric.—Chalk is gradually added to boiling lemon juice, the insoluble lime citrate formed, washed with hot water, and decomposed by being boiled with sulphuric acid; the filtered solution is concentrated by heat; the lime sulphate crystallizes first and is removed; finally, the solution is further concentrated, and the citric acid allowed to crystallize. $H_3C_6H_5O_7$. H_2O.

Tannic.—Substances containing tannin (galls) are broken up and macerated in ether containing spirit and water; the acid being dissolved, the menstruum is evaporated.

2. *Prepared from combinations.*

Carbonic.—This gas is given off in the decomposition of lime carbonate (marble), with hydrochloric or sulphuric acids; also in the decomposition of carbonates with acids. H_2CO_3 or CO_2.

Hydrochloric; Hydrocyanic, dil.; Nitric.—The salts respectively sodium chloride, potassium ferrocyanide, sodium nitrate; are distilled with sulphuric acid; and the acids condensed in the receiver. In preparing the first two, water is previously placed in the receiver, but for the nitric acid water is added only to the sulphuric acid and nitrate. Percentage HCl. 31.8, HCN.2. HNO_3.70.

Sulphurous.—Water charged to a density of 1.04 with sulphurous acid gas procured by distilling sulphuric acid with charcoal, carbonic acid is also formed: or, the sulphurous acid gas given off in making mercury sulphate may be utilized. (P.F.) SO_2. 9.2 per cent.

Tartaric.—Prepared in a similar manner to citric acid from the acid potassium tartrate; but calcium chloride is necessary to decompose the neutral potassium tartrate left in solution. $H_2C_4H_4O_6$.

3. *Prepared by combination.*

Acetum, vinegar; Arsenious; Oxalic (appendix); Phosphoric, dil.; Sulphuric.—These acids are prepared by oxidizing various substances, thus: alcoholic solutions by absorbing oxygen become acetous; by roasting arsenical ores arsenious acid is formed; sugar oxidized by being boiled with nitric acid is converted into oxalic acid, phosphorus treated in a like manner by distillation, gives phosphoric acid; sulphur oxidized by combustion, and further oxidized by the vapours of water and nitrous acid, forms sulphuric acid. H_2SO_4. 96.8 per cent.

Acetic.—Obtained from wood by destructive distillation; the condensed liquor is saturated with lime, the lime acetate formed, when purified by crystallization, is decomposed with sodium sulphate; and from the resulting sodium acetate, the acetic acid is procured by distillation with sulphuric acid. $HC_2H_3O_2$. 33 per cent. (Glacial × 3.)

Gallic.—Tannic acid, by prolonged fermentation, breaks up into gallic acid and grape sugar. Mix powdered galls into a paste with water, place this in a warm situation for a few months, supplying water lost by evaporation; squeeze the dark mouldy mass free from moisture, boil the solid portion in water, filter hot, gallic acid is deposited as the solution cools. $H_3C_7H_3O_5$. H_2O.

4. *Acids differing in strength from those already mentioned.*

Hydrochloric, dil.; Nitric, dil.; Sulphuric, dil.—These are so diluted with water that as acids, each has the same power; that is, a volume of one will saturate as much soda as a volume of the other.

Acetic, dil.—One volume of acetic acid diluted with water to eight volumes.

Acetic, glacial.—A concentrated acetic acid; about three times the strength of the ordinary acetic acid.

Nitro-Hydrochloric, dil., made by mixing the two acids named, and after twenty-four hours diluting them with water; it must not be regarded as a simple mixture of nitric and hydrochloric acids.

Sulphuric, Aromatic.—Prepared by diluting sulphuric acid with spirit, and macerating therein for seven days ginger and cinnamon. It contains about a fourth less anhydrous acid than the diluted sulphuric acid.

Salts.

MONADIC OR UNIVALENT RADICALS.

ACETATES.—General process. Decompose a carbonate or an oxide with acetic acid, evaporate solution, and crystallize resulting acetate.

Ammonium, sol.; Potassium; Sodium; Zinc.—These acetates are produced by the action of acetic acid on carbonates; the decomposition of the zinc carbonate is assisted by heat, in which this process differs from the other three; further, the solution of the zinc acetate after concentration is allowed to deposit crystals by standing, the crystals being afterwards dried at ordinary temperatures on a porous tile; but the solutions of potassium and sodium acetates are evaporated to dryness, the salts liquefied by heat, and solidified by cooling. $Z.Ac.+2H_2O$. $S.Ac.+3H_2O$.

Lead.—Dissolve lead oxide by the aid of heat in acetic acid somewhat diluted; filter; evaporate till a pellicle forms, then set aside to crystallize; dry the crystals without heat.

Morphia.—Morphia, alkaloid, precipitated from a solution of the hydrochlorate by ammonia, is dissolved in weak acetic acid, this solution of the acetate is evaporated by heat of water bath until it forms on cooling a concretion, subsequently the acetate concretion is dried at a gentle heat and powdered.

Iron, tincture.—A mixture of the solution of iron persulphate with spirit is decomposed by a spirituous solution of potassium acetate; the potassium sulphate formed being insoluble in spirit is easily removed by filtration.

BENZOATE.

Ammonium. — Solution of ammonia and water nearly equal parts, and two-thirds as much benzoic acid as of ammonia is dissolved therein ; the solution, its slight alkalinity being maintained, is evaporated at a gentle heat, and set aside for crystals to form.

HYDRATES.

Lime.—Quick-lime is moistened with half its weight of water, the resulting powder, slaked lime, is passed through a sieve, and should be preserved in a well-stopped bottle.

Potassium, caustic ; Sodium, caustic. — The solutions of these salts are rapidly boiled down to an oily consistence in a silver or clean iron vessel, poured into moulds, and when solid but still warm the salts are put into well-stopped bottles.

Amylic hydrate ; Ethyl hydrate : Amylic Alcohol ; Spirits of Wine. — These are hydrates of certain hydrocarbons ; during saccharine fermentation grape sugar splits up into alcohol and carbonic acid, the spirit is also accompanied by a sort of oily colourless liquid, to which the name amylic alcohol is given, and which is separated in the rectification of crude spirit.

Glycerin.—Fats may be considered as salts with glycerin bases, so when decomposed by alkaline hydrates or by over-heated steam the alkali combines with their acid roots to form soap, or the hydrogen of part of the steam combines with their roots to form acids, and the glycerin base combining with the hydrate forms glycerin. The process is called saponification.

Hydrates occur in solution, and are called solutions in the Pharmacopœia, water is the solvent ; the figures represent the number of grains of the salt in an ounce of the solution:—

Ammonium, strong (126); *Ammonium* (41).—The strong solution occurs only in solution, and is made by charging water with the ammonia procured by decomposing ammonium chloride with slaked lime; the process is assisted by heat, and requires certain cautions to be observed. One volume of strong solution with two volumes of water form the ordinary solution.

Lime (½); *Lime* (7), *saccharated.*—Agitate slaked lime with water, and separate the clear solution; the first is a saturated solution of lime in pure water, sugar is added in the second process to increase the solvent power of the water (lime saccharate formed).

Potassium (27), *Sodium* (18).—Solutions of the carbonates of sodium and potassium are boiled with lime hydrate, an interchange of elements takes place, the insoluble lime carbonate, chalk, subsides; the clear solutions are then transferred to and kept in green glass bottles.

NITRATES.—General process: Dissolve metals or carbonates in nitric acid, and crystallize resulting salts.

Bismuth (*subnit.*); *Iron* (*pernit. sol.*); *Lead* (*also from oxide*); *Mercury* (*acid nit. sol.*); *Silver.*—Formed by the action of nitric acid on metals; the silver solution is aided by heat, concentrated, and the crystallized silver nitrate dried by exposure to air. The iron solution is made entirely without heat, the others require heat to insure perfect combination and expulsion of nitrous gases, but only after solution. Bismuth subnitrate is obtained by decomposing the nitrate with much water.

OLEATES.

Sodium, *Potassium*.—These are salts, the former is known as hard soap, the latter as soft soap; they are produced by saponification of olive oil; *see* Glycerin. The process will be better understood by taking olive oil to be an oleate with a glycerin base; solid fats, stearates, and margarates.

VALERIANATES.—Val. Acid, $HC_5H_9O_2$.

Sodium. — A mixture of diluted sulphuric acid and potassium bichromate is first decomposed by heat, to this mixture (chromic acid) amylic alcohol is gradually added, the vessel being plunged into cold water; oxidation of the amylic alcohol is thus effected and valerianic acid formed; most of the liquid is now distilled over and accurately saturated with soda solution, any floating oil is removed, finally the liquid is evaporated, the remaining salt liquefied by heat, and when cold broken up and put into well-stopped bottles.

Zinc.—Solutions of sodium valerianate and zinc sulphate are brought up nearly to boiling point and mixed, the crystals which are produced as the solution cools are skimmed off; the solution is further concentrated at a heat less than 200°, more crystals are thus obtained. The crystals are drained, and washed with a little cold water till the washings exhibit only traces of sulphates, the crystals are then dried on filtering paper at ordinary temperatures.

HALOID COMBINATIONS.—The elements bromine, chlorine, iodine, and fluorine, are called halogens, or sea-produced elements: they are univalent.

General Process:—Form their alkaline (sodium and potassium) salts, by passing the element into the solution of the alkaline hydrate; other salts, by combining the element directly with metal, by dissolving a metal or its salt in an acid of the element, or by decomposing the solution of a metallic salt by an alkaline haloid, evaporating, &c. The mercury chlorides are generally prepared in this country by sublimation.

BROMIDES.

Ammonium. — No official process: formed by heating ammonium carbonate with hydrobromic acid.

Potassium. — Small quantities of bromine are added to solution of potassium hydrate, until the mixture has acquired a permanent brown tint; the mixture is then evaporated to dryness, and the residue heated with charcoal in an iron crucible to fusion; this is to convert bromate, also formed, into bromide (by deoxidation); the fused mass is afterwards dissolved in water, its solution filtered, and set aside for crystals to form, which are drained, and dried at a gentle heat.

CHLORIDES, &c.

Ammonium; Sodium. — No official processes: may be procured by saturating the hydrates or carbonates with hydrochloric acid. Ammonium chloride is procured by saturating certain products of coal distillation with hydrochloric acid. Sodium chloride occurs native, and is plentiful under the name of common salt.

Antimony, sol.; Calcium.—Antimony sulphide, calcium carbonate, are decomposed with hydrochloric acid by the aid of heat; the calcium chloride is ordered in a solid form, its solution is therefore evaporated, and the salt dried at a heat of 400°.

Zinc; Zinc, sol.—The metal is dissolved in hydrochloric acid by the aid of heat, the solution boiled, filtered, and impregnated with chlorine; zinc carbonate is now added, the brown sediment of iron oxide separated by filtration: if the solid salt be required, the solution is evaporated until a portion solidifies on cooling, when it is poured into proper moulds. Lime hydrate and chlorine are used in the preparation of calcium chloride.

Mercury Perchloride; Mercury Subchloride.—Prepared by sublimation: the perchloride by mixing twenty parts of mercuric sulphate with sixteen of sodium chloride and one of black manganese oxide, and subliming in a suitable apparatus; the subchloride by mixing ten of mercuric sulphate with seven of mercury (forming mercurous sulphate) and five of sodium chloride, and subliming so that the calomel or subchloride falls as a fine powder on the floor of the chamber; it must be afterwards washed in boiling water to free it from any of the perchloride, until the washings do not form a black precipitate with ammonium sulphide, and dried.

Iron Perchloride, strong sol.—Iron wire is dissolved in hydrochloric acid, diluted with its volume of water, at a gentle heat. When the solution is filtered, a little more hydrochloric acid and some nitric acid are added, the mixture heated briskly, and after the sudden evolution of red fumes, concentrated by the heat of a water bath.

Ammoniated Mercury.—This, according to the formula, is really ammonium chloride, in which an atom of mercury has taken the place of two atoms of hydrogen. About equal weights of ammonium solution and mercury perchloride; dissolve the perchloride in twenty times its weight of water by the aid of heat, add the ammonium solution, constantly stirring: collect the precipitate, wash, and dry at a temperature less than that of boiling water.

Chloroform.—Methenyl chloride, or chloroform, is produced by the action of hypochlorites on ethyl alcohol, and various other bodies.

Chlorinated lime, lime hydrate, water and spirit, are cautiously distilled; the product distils over with the first portion of the liquid, the chloroform sinks on agitating the distillate with water, the washing is continued with smaller quantities of water, and finally, the chloroform is agitated with its volume of sulphuric acid, desiccated with calcium chloride, and redistilled in a water bath.

Morphia Hydroch.—Directions for procuring the alkaloid have been given. The hydrochlorate is made by diffusing the alkaloid, morphia, through boiling water, and adding whilst hot diluted hydrochloric acid, so that a neutral solution is obtained, which is then set aside to crystallize. The crystals are drained, and dried on filtering paper.

Potassium Chlorate.—Made by passing chlorine through a strong solution of potassium carbonate, mixed with slaked lime; the solution is afterwards boiled, and set aside to crystallize.

Chlorinated Lime.—Made by exposing slaked lime to the action of chlorine as long as the latter is absorbed: it contains lime hypochlorite, chlorine, &c.

Chlorine is obtained by heating manganese peroxide with hydrochloric acid.

Chlorinated Soda, sol.—(See *Solution.*)

IODIDES.

1. *Combination of Iodine with Metals.*

Cadmium.—Combine the element with the metal in presence of water.

Iron.—Boil iodine with half its weight of fine iron wire, and five times its weight of water; when the froth becomes white, filter the solution quickly through calico, and boil until it will solidify on cooling. Pour it into a porcelain dish, and as soon as it is solidified let it be enclosed in a well-stopped bottle.

Mercury, green; Sulphur.—Certain quantities of the metals and iodine are rubbed well together in a mortar; a little spirit should be added to the mercury during the mixing. The sulphur iodide, when mixed, is heated in a flask to liquefaction; when cold, the flask is broken, and the iodide put into well-stopped bottles.

2. *Decomposition of a Salt with Potassium Iodide.*

Lead—Mercury, red.—Hot solutions, the one of mercury perchloride, the other of lead nitrate, are decomposed by potassium iodide in solution; the precipitates are collected and dried at a gentle heat.

3. *Addition of Iodine to an Alkaline Hydrate.*

Potassium.—Proceed as for the corresponding bromide.

DYADIC OR BIVALENT RADICALS.

BICARBONATES.

Magnesium Carb. Sol.—A mixture of water with recently prepared magnesium carbonate is put into an apparatus with excess of washed carbonic acid, under pressure. After twenty-four hours, the solution is filtered; it contains 13 grs. of carbonate in an ounce.

Potassium; Sodium.—A solution of potassium carbonate, a mixture of the dried and common sodium carbonates, are subjected, in certain apparatus, to the action of carbonic acid. The salts are dried by exposure to air.

BIBORATE.

Sodium.—A native salt. May be made by boiling together boracic acid and sodium carbonate.

CARBONATES.—General Process. Precipitate ordinary metallic carbonates by an alkaline carbonate.

1.—*Dry methods.*

Ammonium.—Obtained from the chloride by sublimation, the chloride being mixed with chalk. $H_2(NH_4)_4(CO_3)_3$.

Potassium; Sodium; Sodium, dried.—Plants which contain salts of these metals are burnt; the carbonate thus formed dissolved out of the ashes and crystallized. Sodium carbonate is more frequently procured by adding sulphuric acid to common salt and decomposing the resulting sodium sulphate by fusion with chalk. The dried is made by heating the carbonate in a porcelain capsule until the liquid first formed is converted into a dry cake. Pot. $+ 2H_2O$. Sod. $+ 10H_2O$.

2. *Wet methods.*

Ammonium carbonate precipitant.

Bismuth; Iron, saccharated; Lead.—The salts from which the carbonates are precipitated are, bismuth nitrate, lead acetate or nitrate, and iron sulphate. From the proneness of iron carbonate to oxidize it is quickly washed with boiling water, expressed, mixed with powdered sugar and dried at a heat not exceeding that of boiling water. Iron carbonate constitutes about a third by weight of the saccharated carbonate. Bismuth carbonate is dried at a heat less than 150°.

Found native.

Lime, chalk; Lime, prepared chalk; Lime, Marmor album.*—The first is found native, and after being washed and dried in small masses, constitutes the second, whiting. Marble is a crystalline form of lime-carbonate.

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* Lime carbonate, *i.e.*, calcium carbonate.

Sodium carbonate precipitant.

Lime, precipitated; Lithium.—The hot solutions of the chlorides are decomposed by similar solutions of the precipitant and the resulting carbonates dried.

Magnesium, Magnesium, light; Zinc.—Made from sulphates, and should in common with most carbonates be dried at a heat less than that of boiling water. The process for the light magnesium carbonate differs from that of the other two in the solutions of precipitant and sulphate being cold and very dilute; the light carbonate does not differ chemically from the other. The mixtures of zinc and of light magnesian carbonate are boiled fifteen minutes, the magnesian carbonate digested with water thirty. All the precipitates are collected on a calico filter.

BICHROMATE.

Potassium.— A potassium chromate is procured from chrome-iron ore by calcination with potassium carbonate or nitrate. By addition of sulphuric acid to the chromate the bichromate is formed.

OXALATE.

Cerium.— Obtained by adding solution of ammonium oxalate to a soluble salt of cerium, when it falls as a white granular powder. The ammonium oxalate is made by neutralizing a boiling solution of oxalic acid with ammonia carbonate and crystallizing solution.

OXIDES.—General process. Subject salts containing very volatile acids to heat; precipitate from the solution of a salt by an alkaline hydrate; heat the metal in a strong heat with free access of air.

1. *The acid of a salt driven off by heat.*

Manganese, Mercury, red.—Subject the nitrates to a moderate heat until the nitric oxide be driven off.

Magnesium, light; Magnesium, Zinc, Lime.—The light carbonate of the first and the carbonates of the others are heated to a dull red heat in a loosely-covered crucible until there is no effervescence when mixed with acids. Lime is mostly obtained by calcination of limestone on a large scale.

2. *Precipitated oxides.*

Antimony.—A solution of the chloride is partly decomposed by addition of water, and finally by sodium carbonate, the precipitated oxide is then washed with boiling water and dried at a heat not exceeding 212°.

Iron, magnetic; Iron, peroxide, moist; Iron, hydrated peroxide.—The magnetic is formed on boiling a solution of iron sulphate and persulphate with soda solution; it must be dried at a heat less than 120°: the humid peroxide is precipitated with soda solution, but without heat and from a solution of iron persulphate, it is preserved moist in a well-stopped bottle, and is ordered to be recently made; the hydrated is prepared by drying the humid at a temperature not exceeding 212°.

Silver.—A solution of the nitrate is decomposed by agitation with lime water, and the resulting oxide dried at a heat not exceeding 212°.

The black and yellow lotions of mercury are familiar examples of the formation of oxides by addition of a hydrate to metallic salts, the hydrate in these examples being lime-water.

3. *Various.*

Ether; Ether, pure.—Ether is procured by distilling rectified spirit, ethyl hydrate, with sulphuric acid at a temperature of 270°: fresh spirit is added as the operation proceeds. The distillate is agitated with lime hydrate and chloride, the clear portion after a few minutes poured off and redistilled at a gentle heat s. g. .735. It contains nearly ten per cent. of alcohol with water.

Pure ether is obtained by washing ether repeatedly with water and then mixing it with quicklime and calcium chloride; after standing twenty-four hours it is distilled therefrom at a gentle heat, s. g. .720 These are oxides of ethyl.

Iron, reduced.—Hydrated iron peroxide is placed in the middle of a gun barrel and kept there by plugs of asbestos; the barrel is now heated in the middle to a red heat, perfectly dry hydrogen is made to pass through it; after a time the heat is lowered, the hydrogen still traversing the tube; the reduced iron is then withdrawn and enclosed in a dry, well-stopped bottle; it is a mixture of metallic iron in very fine powder with a variable amount of magnetic iron oxide.

Hydrogen given off in making zinc sulphate may be utilized in this process; it must be dried by passing through sulphuric acid and afterwards through a tube packed with fragments of calcium chloride.

Mercury with Chalk.—One of mercury is rubbed with two of chalk until metallic globules are no longer visible. It is generally considered to be only mercury in a minute state of division. It is possible that its activity as a medicine is due to a part of the mercury existing as oxide.

Lead.—Heat the metal with free access of air.

PERMANGANATE.

Potassium.—Dissolve caustic potash in little less than its weight of water; make this into a paste with nearly equal parts of manganese peroxide and potassium chlorate in fine powder, evaporate to dryness, pulverize the mass and expose it to a dull red heat in a covered crucible for an hour; when cool, boil the result in water, neutralize with sulphuric acid, and evaporate till a pellicle forms; set aside to crystallize, purify by recrystallization, and dry the crystals over sulphuric acid.

The potassium chlorate is used on account of its oxygen, and thus the process is shortened, but a similar result would be obtained by heating manganese peroxide and potassium hydrate in the air.

SULPHATES.—General Process. Dissolve metals and alkaloids in sulphuric acid with or without heat; procure the sulphates of the alkaline and earth metals by decomposing a salt with sulphuric acid: evaporate solutions, crystallize salts.

1. *Sulphuric acid on metals.*

Copper; Mercury.—Dissolve the metals in sulphuric acid by the aid of heat, evaporate the mercury solution to dryness and the copper solution so that it will crystallize on cooling.

Iron; Iron granulated; Iron, exsiccated; Zinc.—Dissolve the metals in the acid without heat, boil the solutions, the ferrous impurities in the zinc are separated by chlorine and zinc carbonate in the usual manner. Procure the sulphates in a crystalline form. If the exsiccated iron sulphate be required, heat the sulphate to a heat commencing at 212° and ending at 400°, driving off all aqueous vapour; or if the granulated, filter a hot solution of iron sulphate into spirit, and dry the granular crystals formed on a porous tile. Iron and zinc $+ 7H_2O$.

2. *Sulphuric acid to a salt.*

Alum; Alum, dried.—The official alum is an ammonium and aluminium sulphate; it is manufactured in large quantities. There are many alums, as potassian, iron alum, soda alum, &c.; also a true aluminium sulphate made from a slaty clay loaded with iron bisulphate, or by the addition of sulphuric acid to alumina clay, &c.: from the aluminium sulphate most of the alums are procured.

The dried alum is obtained by subjecting alum to a heat of 400°.

Lime.—Occurs native, as plaster of Paris. May be prepared from a strong solution of calcium chloride.

Magnesium.—Native impure carbonates (magnesite and dolomite) are dissolved in the acid, the solution is concentrated, the sulphate crystallized and purified by recrystallization.

Potassium; Sodium.—Occur as residues; the potassium from the process for nitric acid, the sodium from that of hydrochloric acid. As similar residues are bisulphates, they are neutralized with sodium carbonate, lime hydrate, &c., the salts are purified by crystallization, Sod. $+ 10H_2O$.

3. *Sulphuric acid to alkaloids.*

Atropia, Beberia, Quinia.—These alkaloids obtained by certain processes are treated with diluted sulphuric acid, the quinine sulphate is allowed to crystallize from a concentrated solution; no heat must be used in drying.

The other alkaloid sulphates are evaporated to dryness from their solutions, at a heat not exceeding 100° for the atropia; the beberia is afterwards dissolved in cold water, filtered, and the filtrate evaporated, and when of a syrupy consistence placed on glass plates and dried at a temperature less than 140°. It occurs in scales.

TARTRATES.

Antimony, tartarated.— Mix antimony oxide and acid potassium tartrate into a paste with water, after twenty-four hours add more water, boil, filter, and crystallize; dry the tartrate at the temperature of the air.

Iron, tartarated.—From solution of iron persulphate precipitate peroxide with ammonium solution, mix the peroxide intimately with acid potassium tartrate, let the mixture stand twenty-four hours, apply heat, gradually adding more water, filter, evaporate solution to the consistence of syrup, pour it out to dry (scale) on flat glass plates. Heat should not exceed 140° in this process.

Potassium, acid tartrate.—Obtained from the crude tartar deposited during fermentation of grape juice; it is precipitated from strong solutions of potassium salts by tartaric acid.

Potassium.— A hot solution of potassium carbonate is neutralized by acid potassium tartrate, the solution concentrated until a pellicle forms, when it is set aside to crystallize: the crystals are dried by exposure to air.

Sodium, tartarated.—This salt is really a potassium and sodium tartrate. It is obtained by a process similar to the potassium tartrate, sodium carbonate being substituted for potassium carbonate.

Sodium, citro-tartrate effervescing.—About two parts sodium bicarbonate, one part tartaric acid and a fourth less citric acid, are heated in a pan to 220° and stirred until the mass assumes a granular form.

Must be preserved in well-stopped bottles.

TRIADIC OR TRIVALENT RADICALS.

ARSENIATES.

Iron.—Solutions in boiling water of iron sulphate and sodium arseniate are mixed, decomposition ensues, iron arseniate is precipitated, this is washed, squeezed, and finally dried in a warm air chamber at a temperature not exceeding 100°.

Sodium.—Arsenious acid, sodium nitrate, dried sodium carbonate, and sodium acetate, are mixed and the mixture exposed in a covered clay crucible to a full red heat until effervescence has ceased and complete fusion taken place. The salt is purified by crystallization from a solution in boiling water, the crystals are rapidly dried on filtering paper and transferred to well-stopped bottles. This salt is likely to be mistaken for sodium phosphate, sulphate, &c.

CITRATES.—These salts are very deliquescent.

Lithium; Potassium.—Formed by neutralizing a solution of citric acid with carbonates. The solutions are evaporated, the lithium to a viscid fluid, which is then dried at a heat of 240°, the potassium until the salt granulates. They should be quickly pulverized in a warm mortar, and preserved in well-stopped bottles.

Ammonium, sol.—A diluted solution of ammonium is neutralized with citric acid.

Bismuth and Ammonium, sol.—Made by addition of a solution of bismuth nitrate and ammonium hydrate to solution of citric acid.

Iron and Ammonium.—Iron peroxide is first precipitated from a solution of the persulphate by a strong solution of ammonia; this is dissolved by citric acid, and afterwards solution of ammonia added; the double *citrate* solution is then evaporated to the consistence of syrup, and dried in thin layers at a temperature not exceeding 100°.

Iron and Quinine.—Iron peroxide is precipitated from a solution of the persulphate, and the alkaloid quinia from a solution of its sulphate, both by solution of ammonia; process similar to last, quinia taking the place of ammonia. The iron citrates should be preserved in well-stopped bottles.

PHOSPHATES.

Ammonium.—Saturate phosphoric acid with strong solution of ammonia; evaporate; dry the crystals quickly on filtering paper placed on a porous tile.

Lime; Sodium.—Digest bone-ash in hydrochloric acid, some more in sulphuric acid; these are solutions of acid lime phosphate. The lime phosphate, neutral, is precipitated from the hydrochloric solution by addition of ammonium solution, it should be washed and dried at a gentle heat. Add sodium carbonate to the sulphuric acid solution, concentrate by evaporation, the solution should be rather alkaline, filter through calico, and evaporate; allow the salt to crystallize.

Iron.—Hot solutions of iron sulphate and sodium phosphate are mixed, sodium acetate being added to prevent formation of sulphuric acid; the precipitated phosphate is collected on a calico filter, washed, and dried at a temperature not exceeding 120°.

TETRADIC OR QUADRIVALENT RADICALS.

FERROCYANIDE.

Potassium, yellow prussiate of potash.—Fuse any dry refuse animal matter at a red heat with crude potassium carbonate and iron filings in an iron vessel, exclude the air, treat the melted mass with boiling water; filter, evaporate solution and crystallize. Purify by recrystallization.

VARIOUS.

Antimony, black.—Native antimony sulphide, purified by fusion, and powdered.

Antimony sulphurated.—Boil, for two hours, B. Antimony 1, with Solution Soda 9, making up loss with water, strain through calico, and before it cools add sulphuric acid to excess; collect precipitate on a calico filter, and wash it free from sulphates, and lastly dry it at a heat not exceeding 212°.

Bismuth; Bismuth, purified.—Heat to fusion, in a crucible, Bismuth 10, Nitrate Potash 1, continue the heat until the salt has solidified as a slag over the metal; remove the slag, and repeat the process by adding more potash;* pour the bismuth while fused into proper moulds.

Bone Ash, Os Ustum.—The residue of bones which have been burnt to a white ash with access of air; lime phosphate with about 10 per cent. of lime carbonate.

Bromine, Bromum.—A liquid non-metallic element, obtained principally from sea-water.

Charcoal, animal; Charcoal, wood; Charcoal, purified animal.—The first and second are obtained by exposing bones or wood to a red heat without access of air; the wood charcoal is tolerably pure carbon, the animal charcoal, bone black, consists of carbon with lime phosphate and carbonate, which salts are removed by prolonged digestion in hydrochloric acid, the residue, when washed and dried, is the official Carbo Animalis Purificatus.

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* *Finely* powder bismuth and nitrate, and well mix them each time.

Copper, Cuprum.—Fine copper wire, about No. 25.

Iodine, Iodum.—A solid non-metallic element, obtained principally from the ashes of sea-weeds.

Iron, Ferrum.—Wrought iron free from oxide, in form of wire or nails.

Mercury, Hydrargyrum.—Pure Quicksilver.

Phosphorus.—Obtained by treating bone ash with sulphuric acid, freeing the solution from lime sulphate by filtration and evaporating it to a syrupy consistence; charcoal is then added, and the mixture desiccated at a high temperature; finally the phosphorus is distilled into water.

Potash, sulphurated.—Heat in a crucible to a dull red heat sublimed Sulphur 1, with Carbonate Potash 2; when fused pour the mixture upon a clean flagstone, exclude the air while the salt solidifies; preserve in a well-stopped green-glass bottle.

Pyroxylin (see *Collodion*).—Gun-cotton is made by immersing cotton for a few minutes in a mixture of sulphuric and nitric acids; the cotton is then freed from sulphuric acid by washing, and dried.

Silver, refined.—Argentum Purificatum. Pure metallic silver.

Sulphur sublimed; *Sulphur precipitated.*—Crude sulphur is imported chiefly from Sicily. Sublimed sulphur is procured by heating crude sulphur to 180°, and collecting the sublimate. Precipitated Sulphur is prepared by boiling together for 15 minutes Sublimed Sulphur, Slaked Lime, and Water (about 1, ½, and 4); the solution being filtered, the residue is again boiled with water, and finally the filtered solutions are diluted (1 sul. in 8), and decomposed* with hydrochloric acid; the precipitated sulphur must be washed, and dried at a temperature below 120°.

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* SH_2 evolved.

Zinc, Zinc granulated.—Fuse zinc in an earthen crucible at just a sufficient temperature; pour the fused zinc in a thin stream into twenty parts of water; remove the granulated zinc, and dry it.

SOLVENTS.

Alcohol. — R. Spirit dissolves Acet. Morphia, Acids, arsenic, benzoic, carbolic, gallic, organic. Aniline, Atropine, Balsams, Brucine, Camphor, Castor-oil, Chloroform, Chloride Calcium, Cinchonine, Conine, Emetine, Glycerin, Iod. Cadmium, Iodine, Mannite, Narcotine, Nitrobenzine, Oils, some volatile; Quinia, Resins, many, Soap, Sulphur, &c. Crystals of salts for the microscope may be obtained by agitating a saturated solution of the salt in water with two volumes of spirit.

Chloroform dissolves Alkaloids, atropine, narcotine, quinine, veratria; benzoin, bromine, camphor, caoutchouc, copal, fats, gutta-percha, iodine, mastic, and most of those substances which alcohol dissolves; it mixes with alcohol, ether, oil, but not with glycerin.

Ether dissolves Acetone; Acids, benzoic, carbolic, hydrocyanic, gallic, lactic, valerianic; Alkaloids, most; conine, narcotine, nicotine; alcohol, amylic, bromine, camphor, chloroform, fats, oils, olein, iodine, nitrobenzine, paraffin, perchloride and red iodide of mercury, phosphorus; Resins, many; Sulphur.

Glycerin dissolves at least 10 per cent.; Acet. Lead, Acids, acetic, benzoic, citric, gallic, lactic, tannic, tartaric; Alkaline, arseniates, hydrates, hypochlorites; Chlorides, ammonium, zinc; Creosote, Iodides, iron, potassium; Soda, borate, carbonate; Sulphates, alum, atropia, copper, iron, zinc; glycerin also dissolves small quantities of many alkaloids and their salts; it does not dissolve acids of fats, benzine, camphor, chloroform, ether, oils, nor sulphide of carbon.

Sulphide of Carbon dissolves camphor, caoutchouc, fats, gutta-percha, iodine, oils, phosphorus; Resins, many; sulphur. It mixes with alcohol, ether; alcoholic solution is stable when peppermint oil is added. Phosphorus and sulphur may be obtained from the solution in a crystalline form.

Water.—Boiling water dissolves at least five times as much as cold water of most of the salts; in the case of lime and magnesia it dissolves less, and the bicarbonates of potash and soda it decomposes ($2\ KHCO_3 = K_2CO_3 + OH_2 + CO_2$).

One ounce, or 480 minims, or 437.5 grains of distilled water at 60° dissolve the following salts, the quantities being expressed in grains (about):—Acids, arsenious transparent, 8; benzoic, 2; carbolic, 21; citric, 585; gallic, 4; oxalic, crys. 48; tannic, freely, tartaric, 600: Alum, 44; Ammonium, benzoate, 89; bromide, 290; carbonate, 109; chloride, 162.

Borax, crys. 35; Iron, ammonio-citrate, and quinine citrate, 874; sulphate crys. 220; tartarized, 109.

Lead, acetate, crys. 259; Lithium, carbonate, 4; citrate, 175; Magnesium, sulphate, 448.

Mercury, perchloride, 24; Potassium, acetate, 1312: acid tartrate, 2; bicarbonate, 107; chlorate, 26; nitrate, 110; sulphate, 44; tartrate, 110; Silver, nitrate, 437; Sodium, bicarbonate, 44; sulphate, 140; tartarized, 299. Borax aids the solubility of many materials; boracic acid boiled with cream of tartar forms a very soluble salt.

FORMULÆ AND CHARACTERISTICS OF THE MORE IMPORTANT SALTS.

1. Base elements; symbols; equivalent numbers.

MONADS′.

Ammonium; NH_4; 18: volatile; when heated with alkalies, ammonia given off; with mercuric iodide, in a solution of iodide and hydrate of potassium, a brown precipitate.

Lithium; L; 7: carmine-red colour to flame.

Potassium; K.; 39: not volatile; violet colour to flame; acid tartrate of potash precipitated on addition of tartaric acid to strong solutions.

Silver; Ag.; 108: white precipitate, soluble in solution of ammonia, with soluble chlorides; displaced by copper, and mercury.

Sodium; Na.; 23: not volatile; yellow colour to flame; property in common with alkalies of not giving a precipitate with alkaline carbonates.

DYADS″.

Barium; Ba.; 137: Any soluble sulphate gives with solution of a barium salt a white precipitate, which is insoluble in nitric acid and is not blackened by sulphide of hydrogen.

Cadmium; Cd., 112: A yellow precipitate with sulphide of hydrogen, which disappears on the addition of nitric and hydrochloric acid; displaced by zinc.

Calcium; Ca.; 40: Soluble oxalates give with lime solution a white precipitate which is insoluble in acetic acid.

Copper; Cu.; 63.5: Displaced by iron.

Magnesium; Mg.; 24: A white precipitate with caustic alkalies, which is soluble in a solution of sal ammoniac.

Mercury; Hg.; 200: Metal may be procured by heating a salt with dry carbonate of soda; displaced by copper.

Zinc; Zn.; 65: Its distinguishing characteristic is a white precipitate with sulphide of ammonium, which is insoluble in excess of caustic alkali.

TRIADS$'''$.

Gold; Au.; 196.5: A brown precipitate, fusible into a bead of gold, with ferrous sulphate.

TETRADS$''''$.

Platinum; Pt.; 197: Most of the salts give a yellow precipitate with salts of ammonia; displaced by zinc.

Aluminium; Al.; 27.5: A white precipitate with alkaline hydrates soluble in excess; heated in a crucible with nitrate of cobalt, take a fine blue colour.

Iron; Fe.; 56: A blue precipitate, or a white precipitate which becomes blue on exposure to air, with ferrocyanide of potassium.

Lead; Pb.; 207: A white precipitate blackened by sulphide of hydrogen or ammonium, and soluble in thirty parts of boiling water, with a soluble chloride.

Tin; Sn.; 118: A white precipitate with a solution of ferrocyanide of potassium; displaced by iron and zinc.

2. Root elements, or radicals; symbols or formulæ; equivalent weight the sum of those of the atoms.

MONADIC—B$'$R$'$; B$''$ 2R$'$; B$'''$ 3 R$'$; &c.

Acetates—$C_2H_3O_2$: acetic acid evolved on addition of sulphuric acid.

Benzoates—$C_7H_5O_2$: benzoic acid thrown down on addition of hydrochloric acid.

Bromides—Br.: treated with strong sulphuric acid, with or without peroxide of manganese, bromine is disengaged.

Chlorides—Cl. : treated with sulphuric acid and peroxide of manganese, chlorine is evolved ; mostly soluble, those of mercury and silver are exceptions.

Iodides—I. : deposit iodine on addition of sulphuric acid, or, if heated together, violet vapours are disengaged.

Nitrates—NO_3 : a few grains of sulphate of iron boiled in a little dilute sulphuric acid and a nitrate added, form a brownish black solution.

DYADIC—B'_2R'' ; $B''R''$; $B'''_2\ 3\ R''$, &c.

Bicarbonates—$H'CO_3$: those of potash and soda may be distinguished from the carbonates of these metals by their giving no precipitate with sulphate of magnesia.

Carbonates—CO_3 : effervesce on addition of acids ; decomposed when strongly heated with charcoal, many without charcoal. Carbonic acid precipitates lime-water (chalk).

Oxides—O : many reduced when heated with charcoal and exposed to a current of hydrogen ; those which are not reduced by hydrogen for the most part give an alkaline reaction to water.

Sulphates—SO_4 : occasion a white precipitate, insoluble in acids, with a soluble salt of barium.

Tartrates—$C_4H_4O_6$: neutral tartrates give a precipitate with chloride of calcium ; tartrates give a precipitate with nitrate of silver, which blackens on being boiled ; blackened when heated with sulphuric acid.

TRIADIC. B'_3R''' ; $B_3''\ 2\ R'''$, &c.

Citrates—$C_6H_5O_7$; neutral citrates give a white precipitate with nitrate of silver, which becomes yellow on being boiled ; citrates, when heated with sulphuric *acid,* become yellow.

Phosphates—PO_4; heated with boracic acid to a high temperature, phosphorus evolved; a dry phosphate heated with potassium is converted into a phosphide, which in contact with water disengages phosphuretted hydrogen; no acid vapours given off when heated with sulphuric acid.

The metals, Manganese, Antimony, Arsenic, and Chromium, may be classed with the radicals.

Manganese $Mn.^{iv}$; flesh-coloured precipitate with sulphide of ammonium, which is soluble in acetic acid; heated on platinum foil with carbonate of soda and nitre, a bluish-green mass is left.

Antimony $Sb.^{v}$: displaced by copper; oxide amorphous; orange or brick-red precipitate with sulphide of hydrogen, which is dissolved by sulphide of ammonium, but reprecipitated by acids.

Arsenic $As.^{v}$: displaced by copper; oxide crystalline; salts fused with carbonate of soda give a little bead of the metal; heated with zinc and solution of caustic potash arseniuretted hydrogen is given off which turns a piece of white filtering paper, moistened with solution of nitrate of silver, a purplish-brown.

Chromium $Cr.^{vi}$; pale yellow precipitate with barium salts; bright yellow precipitate with lead salts; crimson precipitate with silver salts.

Note—$^{II}Fe^{II}$ $^{I}Fe^{III}$ $^{II}Pb^{II}$ &c.

PRINCIPAL DECOMPOSITIONS OCCURRING IN PREPARING THE OFFICIAL SALTS.

1. *Metal + Acid.*

(*a.*) *Hydrogen evolved.*

$Fe + SO_4H_2 = FeSO_4 + HH$ or H_2
$Zn + 2\,ClH = ZnCl_2 + HH$ or H_2
$Zn + SO_4H_2 = ZnSO_4 + HH$ or H_2

(*b.*) *Nitric oxide evolved.*

$Ag_2 + 8\,NO_3H = 6\,AgNO_3 + N_2O_2 + 4\,OH_2$
$Bi_2 + 8\,NO_3H = 2\,Bi\,3\,NO_3 + N_2O_2 + 4\,OH_2$
$Fe_2 + 8\,NO_3H = 2\,Fe\,3\,NO_3 + N_2O_2 + 4\,OH_2$
$3\,Hg'' + 8\,NO_3H = 3\,Hg\,2\,NO_3 + N_2O_2 + 4\,OH_2$

(*c.*) *Sulphurous acid evolved.*

$Hg + 2\,SO_4H_2 = HgSO_4 + SO_2 + 2\,OH_2$

2. *Salts + Acid or Acid Salt.*

(*a.*) *Carbonic acid evolved.*

$CaCO_3 + 2\,ClH = CaCl_2 + CO_2 + OH_2$
$FeCO_3 + 2\,ClH = FeCl_2 + CO_2 + OH_2$
$K_2CO_3 + 2\,C_2H_3O_2H = 2\,KC_2H_3O_2 + CO_2 + OH_2$
$3\,K_2CO_3 + 2\,C_6H_5O_7H_3 = 2\,K_3C_6H_5O_7 + 3\,CO_2 + 3\,OH_2$
$K_2CO_3 + 2\,KC_4H_4O_6H = 2\,K_2C_4H_4O_6 + CO_2 + OH_2$
$MgCO_3 + SO_4H_2 = MgSO_4 + CO_2 + OH_2$
$Na_2CO_3 + 2\,C_2H_3O_2H = 2\,NaC_2H_3O_2 + CO_2 + OH_2$
$Na_2CO_3 + 2\,KC_4H_4O_6H = 2\,KNaC_4H_4O_6 + CO_2 + OH_2$
$2\,Na_2CO_3 + (PO_4)_2CaH_4 = CaCO_3 + CO_2 + OH_2 + 2\,Na_2PO_4H$

$$\left.\begin{array}{l}4\,Na_2CO_3\\ 4\,NaNO_3\end{array}\right\} \left.\begin{array}{l}+\,3\,As_2O_3+\\ \quad 3\,OH_2\end{array}\right\} = 6\,Na_2AsO_4H + 4\,CO_2 + 2\,N_2O_2$$

$$\left.\begin{array}{l}(NH_4)_2CO_3\\ NH_4CO_3H\end{array}\right\} + 3\,C_2H_3O_2H = 3\,NH_4C_2H_3O_2 + 2\,CO_2 + 2\,OH_2$$

$$\left.\begin{array}{l}2\,Zn\,2\,OH\\ ZnCO_3\end{array}\right\} + 6\,C_2H_3O_2H = 3\,Zn\,2\,C_2H_3O_2 + CO_2 + 5\,OH_2$$

(*b.*) *Other acids formed.*

$CaC_4H_4O_6 + SO_4H_2 = CaSO_4 + C_4H_4O_6H_2$
$Ca_3\,2\,C_6H_5O_7 + 3\,SO_4H_2 = 3\,CaSO_4 + 2\,C_6H_5O_7H_3$
$FeS + SO_4H_2 = FeSO_4 + SH_2$

$$\left.\begin{array}{l}3\,FeSO_4\\ 2\,NaC_2H_3O_2\end{array}\right\} + 2\,Na_2AsO_4H = Fe_3\,2\,AsO_4 + 2\,C_2H_3O_2H + 3\,Na_2SO_4$$

$2\,K_4FeCy_6 + 3\,SO_4H_2 = 3\,K_2SO_4 + 6\,CyH + K_2FeCy_6$
$KNO_3 + SO_4H_2 = KHSO_4 + NO_3H$
$2\,NaCl + SO_4H_2 = Na_2SO_4 + 2\,ClH$
$2\,NaC_2H_3O_2 + SO_4H_2 = Na_2SO_4 + 2\,C_2H_3O_2H$
$\mathit{Sb_2S_3} + 6\,ClH = 2\,SbCl_3 + 3\,SH_2$

Salts + Acid or Acid Salt—(continued).

(*c.*) *Salts formed.*

$CuO + SO_4H_2 = CuSO_4 + OH_2$

$Ca_3\,2\,PO_4 + 4\,ClH = 2\,CaCl_2 + (PO_4)_2CaH_4$

$$\left.\begin{array}{l} K_2CO_3 + CO_3H_2 = 2\,KHCO_3 \\ Na_2CO_3 + CO_3H_2 = 2\,NaHCO_3 \end{array}\right\} + \textit{i.e.},\ CO_2 + OH_2 = CO_3H_2$$

$MnO_2 + 4\,ClH = MnCl_2 + Cl_2 + 2\,OH_2$

$NH_4OH + ClH = NH_4Cl + OH_2$

$NH_4OH + C_7H_5O_2H = NH_4C_7H_5O_2 + OH_2$

$NH_4OH + SH_2 = NH_4SH + OH_2$

$2\,NH_4OH + PO_4H_3 = (NH_4)_2HPO_4 + 2\,OH_2$

$PbO_4 + 2\,C_2H_3O_2H = Pb\,2\,C_2H_3O_2 + OH_2$

$Sb_2O_3 + 2\,C_4H_4O_6KH = 2\,SbKOC_4H_4O_6 + OH_2$

Metal or Salt + Halogen.

$2\,Ca\,2\,OH + 2\,Cl_2 = CaCl_2 + Ca\,2\,ClO +$

$Cd + I_2 = CdI_2$

$Hg_2 + I_2 = 2\,HgI$

$6\,KOH + 3\,I_2 = 5\,KI + KIO_3 +$

$6\,KOH + 3\,Br_2 = 5\,KBr + KBrO_3 +$

$Na_2CO_3 + Cl_2 = NaCl + NaClO +$

Deoxidation of Salts.

$BaSO_4 + 4\,C = BaS + 4\,CO$

$CaCO_3 + \text{Heat} = CaO + CO_2$

$KIO_3 + 3\,C = KI + 3\,CO$

$KBrO_3 + 3\,C = KBr + 3\,CO$

$2\,Hg\,2\,NO_3 + \text{Heat} = 2\,HgO + 2\,N_2O_4 + O_2$

$3\,MgCO_3,Mg2OH + \text{,,} = 4\,MgO + 3\,CO_2 + OH_2$

$ZnCO_3 2ZnO_2H_2 + \text{,,} = 3\,ZnO + CO_2 + 2\,OH_2$

Salt + Water and Salt + Salt.

(*a.*) *Salt + Water.*

$CaO + OH_2 = Ca\,2\,OH$

$3\,K_2MnO_4 + 2\,OH_2 = 4\,KOH + MnO_2 + K_2Mn_2O_8$

$$\left.\begin{array}{l} 4\,Na_2CO_3 \\ 4\,MgSO_4 \end{array}\right\} + OH_2 = 3\,MgCO_3,Mg2OH + 4\,Na_2SO_4 + CO_2$$

$$\left.\begin{array}{l} 3\,Na_2CO_3 \\ 3\,ZnSO_4 \end{array}\right\} + 2\,OH_2 = ZnCO_3,2ZnO_2H_2 + 2\,CO_2 +$$

$NH_3 + OH_2 = NH_4OH$

$12\,SbCl_3 + 15\,OH_2 = 2\,SbCl_3,\,5\,Sb_2O_3 + 30\,ClH$

(*b.*) *Salt + hydrate.*

$2\,AgNO_3 + Ca\,2\,OH = Ca\,2\,NO_3 + Ag_2O + OH_2$

$Fe_2 3\,SO_4 + 6\,NaOH = 3\,Na_2SO_4 + Fe_2\,6\,OH$

$$\left.\begin{array}{l} Fe_2 3\,SO_4 \\ FeSO_4 \end{array}\right\} + 8\,NaOH = 4\,Na_2SO_4 + Fe_3O_4 + 4\,OH_2$$

$HgCl_2 + Ca\,2\,OH = CaCl_2 + HgO + OH_2$

$HgCl_2 + 2\,NH_4OH = NH_4Cl + NH_2HgCl + 2\,OH_2$

$Hg_2Cl_2 + Ca\,2\,OH = CaCl_2 + Hg_2O + OH_2$

$K_2CO_3 + Ca\,2\,OH = CaCO_3 + 2\,KOH$

$$\left.\begin{array}{l} KClO_3 \\ 3\,MnO_2 \end{array}\right\} + 6\,KOH = KCl + 3\,K_2MnO_4 +$$

$Na_2CO_3 + Ca\,2\,OH = CaCO_3 + 2\,NaOH$

Salt + *Salt*—(continued).

(*c.*) *Carbonate + sulphate, &c.*

$CaCO_3 + Na_2S = CaS + Na_2CO_3$

$K_2CO_3 + FeSO_4 = K_2SO_4 + FeCO_3$

$(NH_4)_2CO_3 + FeSO_4 = (NH_4)_2SO_4 + FeCO_3$

$Na_2CO_3 + CaCl_2 = 2\,NaCl + CaCO_3$

$3\,Na_2CO_3 + 2\,SbCl_3,5\,Sb_2O_3 = 6\,NaCl + 6\,Sb_2O_3 + 3\,CO_2$

(*d.*) *Sulphate + haloid, &c.*

$HgSO_4 + 2\,NaCl = HgCl_2 + Na_2SO_4$

$Hg_2SO_4 + 2\,NaCl = Hg_2Cl_2 + Na_2SO_4$

$ZnSO_4 + 2\,NaC_5H_9O_2 = Zn\,2\,C_5H_9O_2 + Na_2SO_4$

$Pb\,2\,NO_3 + 2\,KI = PbI_2 + 2\,KNO_3$

$HgCl_2 + 2\,KI = HgI_2 + 2\,KCl$

Fermentation, &c.

$C_{18}H_{30}O_{15} + OH_2 = 2\,C_6H_{10}O_5 + C_6H_{12}O_6 = \left\{\begin{array}{l}2\,C_2H_5OH\\2\,CO_2\end{array}\right.$

Starch + Water = Dextrin + Grape sugar = 2 Alcohol + 2 Carbonic acid.

$C_2H_5OH + O = C_2H_4O + OH_2$

Alcohol + Oxygen (air) = Aldehyde + Water

$C_2H_4O + O = C_2H_3O_2H$ Acetic acid

$C_2H_5OH + SO_2OHOH = SO_2OHOC_2H_5$

Alcohol + Sulphuric acid = Ethyl sulphuric acid

$C_2H_5OH + SO_2OHOC_2H_5 = SO_2OHOH + C_4H_{10}O$ Ether

$2\,C_2H_5OH + 5\,CaCl_2O_2 = 2\,CHCl_3$ Chloroform $+ 2\,CaCO_3 +$

$C_3H_5(OC_{18}H_{35}O)_3 + 3\,K'OH = 3\,K'OC_{18}H_{35}O + C_3H_5(O'H)_3$

Stearin + Potassium hydrate = Potassium stearate, soap + Glycerin

$C_3H_5(OC_{18}H_{35}O)_3 + 3\,OH_2 = 3\,OC_{18}H_{35}OH + C_3H_5(OH)_3$

Stearin + Water (overheated steam) = Stearic acid + Glycerin

b. Substances generally of an indefinite chemical composition.

The preliminary preparation of the principal drugs, or condition in which they are used. Where the condition is simply stated after the drug or drugs, "*for all preparations*" must be understood, as the exceptions will be given; dried substances entering into the composition of pills, powders, and confections, or suspended in mixtures, being always powdered, form exceptions which will not require to be again mentioned.

Plant—part, appendage, &c., dried: Broom, Chamomile, *Hop*, condition as described. Cloves, Dulcamara, bruised. Chiretta, cut small, for tincture bruised. Ergot, Indian Hemp, Galls in tincture, Lobelia, Savin in tincture; coarse powder. Galls in fine powder for ointments. Broom, fresh for juice. Red Poppy Petals, fresh. Red Rose Petals, fresh in confection, but dried in syrup and infusion. Savin, fresh, bruised for ointment.

Inspissated Juices, &c.—Benzoin, Castor, Catechu, Kino, Myrrh; coarse powder. Aloes, Assafœtida; small fragments. Opium; sliced, morphia and extract; in powder, ointment of galls; in coarse powder, tinctures.

Rhizome, Root—dried; Aconite, Arnica, Belladonna, Ginger in tincture, G. Hellebore, Male Fern, Pellitory, Podophyllum, Scammony, Sumbul; coarse powder. Rhatany, Senega, Serpentary, Valerian; also in coarse powder, but bruised for their infusions. Gentian, Ginger for infusion of senna, Pareira, Pomegranate, Rhubarb; sliced, but gentian in the compound tincture is cut small and bruised, and pareira for extract is in coarse powder. Hemidesimus, Ipecacuanha in wine, Squill; bruised. Sarsaparilla, cut transversely. Calumba, cut small, but merely bruised in the aromatic iron mixture. Ginger, fine powder in the stronger tincture. Dandelion, in decoction sliced and bruised. Liquorice, for extract, in coarse powder. Dandelion, fresh, in extract and juice. Liquorice, fresh, bruised in compound decoction of sarsaparilla, sliced in the infusion of linseed. Horseradish, fresh, scraped.

Wood.—Guaiacum, Logwood, Quassia, Sassafras; small chips, quassia rasped for extract.

Bark.—Elm, Mezereon for extract, Oak; bruised. Bebeeru, Canella, Cusparia, Cinchona except in its tinctures, Cinnamon in aromatic sulphuric acid, decoction of logwood, and its tinctures; in coarse powder, but cinchona for tincture is in moderately fine powder, and cinnamon is bruised for other preparations. Orange-peel dried, cut small, for tincture bruised. Lemon-peel, fresh, sliced thin for tinctures, cut small for infusions.

Leaves—dried: Belladonna, Buchu, Digitalis, Hyoscyamus; tinctures; Hemlock, cataplasm, Kousso, infusion: in coarse powder. Bearberry, Buchu, bruised. Matico cut small, Digitalis, as described; for their infusions. Senna, broken small, syrup and tincture; whole in other preparations.

Leaves—fresh: Aconite, Belladonna, Cherry-laurel, Hemlock, Hyoscyamus; *see* waters, juices, and extracts.

Fruit, *Seed.*—Capsicum, Caraway, Cardamom, Colchicum, Coriander, Dill, Hemlock, Stramonium; bruised, but coriander, in syrup of rhubarb, stramonium for its extract, are in coarse powder. Poppy-capsule, bruised for decoction, the seeds removed and capsule bruised, in syrup and extract. Linseed, as described. Nux-vomica steamed and finely powdered for its preparations; Cubebs and Pepper, in powder; Pimento, bruised.

Castor, coarse powder; Cantharides, ointment as described, tincture, coarse powder, other preparations in powder. Cochineal, in powder.

NOTE.—Ergot, Stramonium, freed from their oils for extracts; in tinctures this is not required.

ALKALOIDS.

Aconitia, Atropia, Digitalin, Santonin, Strychnine, and Veratria: these are the active principles of various plants already described in the Materia Medica.

Characters.—Solids of variable whiteness, no residue when heated with free access of air, hence lime may be detected as an impurity, and almost insoluble in water, but generally soluble in chloroform. The salts of these and other alkaloids will be found elsewhere.

The processes for procuring alkaloids are too long to be given here; the principle followed in their preparation may be understood by considering alkaloids as bases, analogous in constitution to ammonia, and somewhat in their characters to certain oxides, existing in plants in combination with acids as salts, hence by dissolving out these salts by digestion, maceration, and percolation with menstrua, and decomposing such solutions with an alkali, as ammonia or lime, the alkaloid is precipitated.

CATAPLASMS.

Process.—To the dry ingredients in powder add sufficient linseed meal to make four ounces; and let this mixture be added, gradually, and with constant stirring, to ten ounces of boiling water. Exceptions and quantities in each cataplasm will be found in the table below.

Mustard is rendered almost inert by boiling or even hot water; hence it should be added when the poultice has somewhat cooled. Yeast cataplasm differs from all the others in not having boiling water or linseed meal, and in being nearly double the weight; it is really dough, useful on account of the carbonic acid contained and generated therein.

CATAPLASMA.

„ Carbonis. Charcoal, ½ oz. (half spread on surface). Bread, 2 oz. (crumb soaked on hob).

„ Conii. Hemlock leaves in powder, 1 oz.

„ Fermenti. Beer yeast, 6 oz. Flour, 14 oz. Water, 6 oz. (100°).

„ Lini. Olive oil, ½ oz.

CATAPLASMA—*continued.*

„ Sinapis. Mustard, Linseed meal, each 2½ oz. (strong).

„ Sodæ Chloratæ. Sol. chlorinated soda, 2 oz. Boiling water, 8 oz.

CONFECTIONS.

In these the dry ingredients are to be reduced to a fine powder; enough pulp, syrup, or clarified honey is ordered to make them to the consistence of soft pastes; those of roses are confections, the others are electuaries. Heat is required in one process, that for making the confection of senna; for this same confection, cassia pulp, tamarinds, prunes, and figs, are retained in the Materia Medica.

CONFECTIO.

„ Opii. Compound powder of opium, 192 grains. Syrup, an ounce (Opium, 1 in 39½).

„ Piperis. Pepper, 2. Caraway, 3. Honey, 15.

„ Rosæ Caninæ. Pulp from one of Hips.* Sugar, 2.

„ Rosæ Gallicæ. Petals beaten to a pulp, 1. Sugar, 3.

„ Scammonii. Scammony. Syrup, each 1. Ginger, Honey, each ½. Clove-oil, $\frac{1}{48}$. Caraway-oil, $\frac{2}{48}$.

„ Sulphuris. Sulphur, sublimed, Syrup of Orange-peel, each, 1. Acid tartrate of potash, ¼.

„ Terebinthinæ. Turpentine, Liquorice powder, each 1. Honey, 2.

„ Sennæ. Figs, 12; Prunes, 6; Water, 24: boil gently four hours, and make up water lost by evaporation. Add Tamarind, Cassia pulp, each 9; digest 2 hours; rub the pulp of the fruits through a hair sieve, rejecting the hard parts;

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* Freed from Seeds.

dissolve in the pulp at a gentle heat Extract of Liquorice $\frac{3}{4}$, Sugar 30; whilst the mixture is still warm add Senna, powd. 7, Coriander, powd. 3, mix thoroughly, and make by evaporation, or addition of water, the confection 75 (Senna 1 in $10\frac{5}{7}$.)

DECOCTIONS.

Process.—Ingredients, admitting it, sliced, bruised, or coarsely powdered, boiled with water ten minutes; decoction strained, residuum washed, loss made up. Wash cetraria and pearl barley. Digest solids in decoctions of sarsa in 12 parts of boiling water for an hour previously.

Decoctions contain more starch and tannin than similar infusions, but less of aromatic volatile principles.

DECOCTUM.

,, Aloes Compositum. Extract of Socotrine Aloes, 120 grs.; Myrrh, 90 grs.; Carbonate of Potash, 60 grs.; Extract of liquorice, 1 oz. Boil with Water, 20 oz., five minutes, and add Saffron, 90 grs. When cold add Tincture of Cardamoms, 8 oz.; macerate in a close vessel two hours; strain through flannel; make product 30 oz.

	One of Active Ingredient in
,, Aloes Compositum	120
,, Cetrariæ	20
,, Cinchonæ Flavæ (strain cold)	16
,, Granati Radicis (twenty boiled to ten) . .	10
,, Hæmatoxyli. Cinnamon (about $\frac{1}{8}$ in 20) .	20
,, Hordei, 1; Water, 15; boil 20 minutes, and do not make up loss.	
,, Papaveris. Caps, freed from seeds, water, 15	10
,, Pareiræ. Boil 15 minutes	$13\frac{1}{3}$
,, Quercus	16

DECOCTUM—*continued.*	One of Active Ingredient in
„ Sarsæ	8
„ Sarsæ Compositum	8
Sassafras, Guaiacum, chips, Fresh Liquorice root, each $\frac{1}{10}$, Mezereon bark, $\frac{1}{18}$.	
„ Scoparii (dried tops)	20
„ Taraxaci (dried root)	20
„ Ulmi	8

DILUTED ACIDS (*Temperature* 60°).

Acidum Aceticum Dilutum. Acetic Acid, 1; Water to 8.

Acidum Hydrochloricum Dilutum. Hydrochloric Acid, 1; Water to 3$\frac{5}{16}$.

Acidum Hydrocyanicum Dilutum. HCN dissolved in water, constituting 2 per cent. by weight; the only official solution.

Acidum Nitricum Dilutum. Nitric Acid, 1; Water to 5$\frac{1}{6}$.

Acidum Nitro-Hydrochloricum Dilutum. Nitric Acid, 1; Hydrochloric Acid, 1$\frac{1}{3}$. Mix, and allow them to remain 24 hours in a partially-closed bottle; add in successive portions, shaking the bottle, Water, 8$\frac{1}{3}$. Preserve in a stoppered bottle.

Acidum Phosphoricum Dilutum. Phosphoric Acid H_3PO_4, dissolved in water; 10 per cent. by weight of anhydrous phosphoric acid; the only official solution.

Acidum Sulphuricum Aromaticum. Mix Sulphuric Acid, 1, gradually with R. Spirit, 13$\frac{1}{3}$; add, in coarse powder, Cinnamon Bark, $\frac{2}{3}$; Ginger, $\frac{5}{12}$; macerate for 7 days, and filter.

Acidum Sulphuricum Dilutum. Add, Sulphuric Acid, 1, to Water, 11; and when the mixture has cooled to 60°, add more Water to 12 (nearly).

ENEMATA.

Enema (ingredients in each enema).

„ Aloes. Aloes, 40 grs; Carbonate of Potash, 15 grs; Mucilage of Starch, 10 oz.

„ Assafœtidæ. Assafœtida, 30 grs; Water, 4 oz.; rub into an emulsion.

„ Magnesiæ Sulphatis. Sulphate, Olive Oil, each 1 oz.; Mucilage of Starch, 15 oz.

„ Opii. Tincture of Opium, 30 minims; Mucilage of Starch, 2 oz.

„ Tabaci. Infuse for half an hour Tobacco leaf, 20 grs., in Boiling Water, 8 oz.; strain.

„ Terebinthinæ. Turpentine, 1 oz.; Mucilage of Starch, 15 oz.

ESSENCES.

Essentia.

„ Anisi. E. Menthæ Piperitæ. Of the Oils, 1; R. Spirit, 4; mix.

EXTRACTS.

1. *Expressed inspissated juices of fresh plants.*

Extractum.

„ Aconiti, leaves and fl.-tops—Belladonnæ, leaves and young branches—Conii, leaves and young branches—Hyoscyami, leaves and young branches—Lactucæ, flowering-herb. Green extracts. Plants yield about one-half juice, equivalent to a twentieth of extract.

Bruise plants in a stone mortar; press out their juice, and heat it gradually to 130°; separate chlorophyll by a calico filter. Heat the strained liquor to 200° and remove the coagu-

EXTRACTUM—(*continued*).

lated albumen by another filtration; evaporate the freed liquor to the consistence of thin syrup, add the chlorophyll, previously separated, stir assiduously; continue the evaporation at a temperature below 140°, until the extract be of a pilular consistence.

In these and other extracts use the heat of a water-bath for evaporation.

„ Colchici, corm—Colchicum Aceticum corm—Taraxaci, root. Crush and press out juice, allow the feculence to subside; heat the clear liquor to 212°, strain through flannel, evaporate the acetic extract to a soft consistence, the others to a pilular, at a temperature below 160°.

The clear liquor of the dandelion extract must be maintained at boiling heat ten minutes, and then strained.

Add to the colchicum corm, before expression, for the acetic extract, about one of acetic acid to eighteen of corm.

2. *Extracts made with boiling water: exceptions Ergot and Sarsaparilla.*

„ Aloes Barbadensis. E. Aloes Socotrinæ. Aloes in fragments, a pound. Water, a gallon; stir until they are thoroughly mixed. Set aside for twelve hours; evaporate strained liquor to dryness.

„ Anthemidis. Flowers, a pound; water (cold when added), a gallon. Boil to half; strain, press, and filter. Evaporate to pilular consistence, adding fifteen minims of chamomile oil towards the end of the process.

„ Ergotæ Liquidum. Free a pound of ergot, in coarse powder, from its oil by percolating with a pint of ether washed with half a pint of water. Digest

EXTRACTUM—(*continued*).

the freed ergot at 160°, for twelve hours in three pints of water. Press, strain; evaporate liquor to nine ounces; when cold, add eight ounces of spirit. Allow it to stand an hour to coagulate; filter; the filtrate, which is the extract, should measure sixteen ounces.

„ Gentianæ. E. Hæmatoxyli. Gentian sliced root, logwood chips; add about eight times their weight of water. Infuse the gentian two hours, and boil for a quarter of an hour; infuse the logwood twenty-four hours, and boil to half. Strain the infuso-decoctions, evaporate the logwood extract to dryness, the gentian extract to a pilular consistence.

The logwood extract must not be made in iron vessels.

„ Papaveris. Infuse dried coarsely-powdered capsules, freed from seed, in two parts of water for twenty-four hours; percolate to exhaustion with more water. Evaporate the liquor so that a pint corresponds with a pound of capsules, when cold add an eighth of spirit, let the mixture stand twenty-four hours; filter, evaporate filtered liquor to a pilular consistence.

„ Pareiræ. E. Pareiræ Liquidum. Digest root in coarse powder with an equal quantity of water, for twenty-four hours; percolate to exhaustion with more water; evaporate the first extract to a pilular consistence. The other extract is evaporated so that three parts correspond with four of root, and when cold sufficient spirit is added to make one of extract by measure correspond with one of root.

„ Sarsæ Liquidum. Digest a pound of sarsaparilla

Extractum—(*continued*).

root cut transversely, with seven pints of water at 160° for six hours, decant the liquor; repeat the process with the residue and seven other pints of water; express, and filter the mixed liquors, evaporate to seven fluid ounces, and when cold add an ounce of spirit s. g. 1.095.

3. *Extracts made with cold water.*

„ Belæ Liquidum. Macerate the bael twelve hours in four parts of water; repeat the maceration a second and third time for one hour with the same quantities of water. Evaporate, press, and filter through flannel, to such consistence that an eighth part of spirit added will make a fluid ounce of this extract correspond with an ounce of bael.

„ Calumbæ. E. Glycyrrhizæ. Calumba, cut small; liquorice root, coarse powder. Macerate with two and a half parts of water for twelve hours, strain; repeat the process with the residue and more water (gly. 6 hours). Filter the calumba liquors; heat those of liquorice to 212°, and strain through flannel. Evaporate both to a pilular existence.

„ Cinchonæ Flavæ Liquidum. Macerate the Cinchona, in coarse powder, in two and a half parts of water twenty-four hours; percolate to exhaustion with more water. Evaporate the liquors at a temperature less than 160°, so that a pint shall correspond with a pound of the bark; now filter through paper, and continue evaporation until the s. g. of the extract be 1.200, when cold lower the specific gravity to 1.100 with spirit (s. g. doubtful test).

„ Krameriæ. Macerate the root, in coarse powder, in about double its weight of water for twenty-

EXTRACTUM (*continued*).

four hours; percolate to exhaustion with more water: evaporate the liquor to dryness.

„ Opii. Macerate the opium, in thin slices, in two and a half parts of water for twenty-four hours, express the liquor. Reduce the residue to a uniform pulp, macerate with more water, exactly as at first. Repeat the operation a third time. Strain the mixed liquors through flannel, and evaporate to a pilular consistence.

„ Opii Liquidum. Macerate an ounce of extract of opium in sixteen fluid ounces of water for an hour, frequently stirring. Add four fluid ounces of spirit and filter: product should measure a pint.

„ Quassiæ. Macerate the raspings in half their weight of water for twelve hours; percolate to exhaustion with more water. Evaporate the liquor; filter before it thickens; again evaporate until the extract be of a pilular consistence.

4. *Alcoholic extracts; in which rectified spirit is used as a menstruum.*

„ Cannabis Indicæ. Macerate a pound of Indian hemp, in coarse powder, in four pints of spirit seven days; press out the tincture; distil off spirit. Evaporate to a soft extract.

„ Mezerei Æthereum. Macerate a pound of the bark, cut small, in six pints of spirit for three days; strain and press; repeat the process with the residue and two pints of spirit. Mix and filter the strained liquors; recover spirit and evaporate to soft extract; again, macerate this extract in a stoppered bottle with a pint of ether for twenty-four hours, decant; recover ether. Evaporate to soft extract.

„ Nucis Vomicæ. Boil the powdered nux vomica dered, bruised, or sliced; the time of infusion is from a quarter of an hour to two hours; all except that of Cusso are strained. With the exceptions of the infusions of Quassia and Calumba, which require cold water, and those of Chirata and Cusparia, which require water at 120°, boiling water is used for the infusion.

	Quantity in an ounce, or minimum dose.					
INFUSUM	About.	Actual Grs.		Hours.		One of Active Ingredient in
,, Anthemidis	℈j	21.875		qr.		20
,, Aurantii	℈j	21.875		qr.		20
,, Aurantii Compositum	℈ss	10.937		qr.	Cloves $\frac{1}{4}$. Fr. Lemon Peel $\frac{1}{2}$ about	40
,, Buchu	℈j	21.875		one		20
,, Calumbæ	℈j	21.875	cold water	one		20
,, Caryophylli	℈ss	10.937		half		40
,, Cascarillæ	℈ij	43.75		one		10
,, Catechu		16		half	Cinnamon bark $\frac{3}{16}$	28
,, Chiratæ	℈ss	10.937	water at 120°	half		40
,, Cinchonæ Flavæ	℈j	21.875		two		20
,, Cuspariæ	℈j	21.875	water at 120°	two		20
,, Cusso	ʒss	27.343		qr.	(not strained)	16
,, *Digitalis		3	not powdered	one	*dose two to four drachms	145
,, Dulcamaræ	℈ij	43.75		one		10
,, Ergotæ	℈ss	10.937		half		40
,, Gentianæ Compositum		6		one	Orange Peel 1. Fr. Lemon Peel 2	73
,, Krameriæ	℈j	21.875		one		20
,, Lini		16		four	Fresh Liquorice Root $\frac{1}{2}$	30
,, Lupuli	℈j	21.875		two		20
,, Maticæ	℈j	21.875		half		20
,, Quassiæ		6	cold water	half		73
,, Rhei	℈ss	10.937		one		40
,, Rosæ Acidum	℈ss	10.937		half	Dilute Sulphuric Acid six minims to an ounce	40
,, Senegæ	℈j	21.875		one		20
,, Sennæ	℈ij	43.75		one	Ginger nearly $\frac{1}{15}$	10
,, Serpentariæ	℈ss	10.937		two		40
,, Uvæ Ursi	℈j	21.875		two		20
,, Valerianæ		12		one		36

INHALATIONS.

The vapour of the following mixtures to be inhaled by means of a suitable apparatus.

VAPOUR.

„ Acidi Hydrocyanici. Mix ten to fifteen minims of the diluted acid with a drachm of water.

„ Chlori. The vapour from 2 oz. of chlorinated lime moistened with water.

„ Conii. The vapour of hot water passing over the following mixture:—Extract of Hemlock $1\frac{2}{3}$ gr., Solution of Potash, 2 min., Water, 18 min.

„ Creasoti. The air which has passed through a mixture of Creasote 12 min. Boiling water 8 oz.

„ Iodi. The vapour arising from a gently heated mixture of Tincture of Iodine a drachm and 1 oz. of water.

JUICES (*from the fresh plants*).

SUCCUS.

„ Conii, leaves; Scoparii, tops; Taraxaci, root. Bruise; press out the juice, to three volumes of juice add one volume of r. spirit. Set aside for seven days, then filter, and keep in a cool place.

LINIMENTS.

These are liquid or semi-fluid preparations for external use, and are generally rubbed into the skin; camphor occurs in most of them.

1. *Liniments made without spirit.*

a. Incomplete soaps.

LINIMENTUM.

„ Ammoniæ. Mix with agitation, Olive Oil, 3, Solution of Ammonia, 1.

LINIMENTUM—(*continued*).

„ Calcis. Mix with agitation, Olive Oil, Sol. of Lime, equal parts.

„ Hydrargyri. Take equal parts of ingredients. Liquefy Ointment of Mercury by the aid of heat in Camphor Liniment; add the Solution of Ammonia gradually, and mix.

b. Other Liniments made without spirit.

„ Camphoræ. Dissolve Camphor, 1, in Olive Oil, 4.

„ Chloroformi. Mix equal volumes of Camphor Liniment and Chloroform.

„ Terebinthinæ. Dissolve Camphor, 1, in Turpentine, 16; rub with this mixture Soft Soap, 2.

„ Terebinthinæ Aceticum. Mix equal volumes of Acetic Acid, Turpentine, and Camphor Liniment.

„ Potassii Iodidi cum Sapone. Take of Iodide of Potassium and Hard Soap, each 1½, dissolve the soap in water, 7 (by the heat of a water bath); and the iodide in Water, 3, Glycerine, 1. Mix solutions, and when cold, add ⅛ of Lemon-oil.

2. *Liniments made with spirit* (*rectified*).

„ Aconiti. L. Belladonnæ. Moisten the coarsely-powdered roots with spirit, and macerate in a closed vessel three days; percolate with more spirit until a pint of the percolated liquor corresponds with a pound of root, and let each pint of liniment contain also an ounce of camphor.

„ Camphoræ Compositum. Dissolve Camphor, 2½; Lavender-oil, ⅛, in Spirit, 15; add gradually Strong Solution of Ammonia, 5. Shake the mixture till clear.

„ Crotonis. Dilute 1 of Croton Oil to 8, with equal quantities of Cajuput Oil and Spirit.

„ Iodi. Dissolve Iodine 1¼, Iodide of Potassium ½, Camphor ¼, in Spirit, 10.

LINIMENTUM—(*continued*).

„ Opii. Mix equal volumes of Tincture of Opium and Soap Liniment.

„ Saponis. Mix water 2, Spirit 18, Hard Soap 2½, Camphor 1¼, Rosemary oil, ⅜; macerate seven days at a temperature below 70°, and filter.

„ Sinapis Co. Dissolve Ethereal Extract of Mezereon 40 grains, Camphor 120 grains, in Spirit 4 oz., then add Mustard oil, ⅛ oz., Castor oil, ⅝ oz.

LOTIONS.

LOTIO.

„ Hydrargyri Flava. Perchloride of Mercury, 18 grs., Sol. of Lime, 10 oz.

„ Hydrargyri Nigra. Subchloride of Mercury, 30 grs.; Sol. of Lime, 10 oz.

LOZENGES.

The base of these consists of sugar, acacia, and mucilage, with which the active ingredients are mixed and a proper mass formed; this is divided into the requisite number of lozenges, which should be dried at a moderate heat in a hot-air chamber. The mass ordered in the Pharmacopœia is sufficient for seven hundred and twenty lozenges.

The lozenges of morphia, of opium, and of tannin contain also tincture of tolu, those of bismuth contain the carbonates of lime and magnesia, whilst in the opium lozenges extract of liquorice is used instead of the mucilage ordered for the others. Soluble ingredients should be dissolved before they are made into a mass.

TROCHISCI.	Active Ingredients in each loz.
„ Acidi Tannici	gr. ½
„ Bismuth, subnit.	„ 2
„ Catechu	„ 1

Trochisci—(*continued*).	Active Ingredients in each loz.
„ Ferri Redacti	gr. 1
„ Ipecacuanhæ	„ $\frac{1}{4}$
„ *Morphiæ	„ $\frac{1}{36}$
„ *Morphiæ et Ipecacuanhæ	„ $\frac{1}{36}$ Ipec. $\frac{1}{12}$
„ Opii (Ext.)	„ $\frac{1}{10}$ extract
„ Potassæ Chloratis	„ 5
„ Sodæ Bicarbonatis	„ 5

MIXTURES.

In these the principal solvent or vehicle for the ingredients is water; the ammoniacum, almond, brandy, creosote, chalk, guaiacum, and scammony, mixtures, are examples of simple mixture by trituration; milk is the vehicle in the scammony mixture. Resins of scammony and guaiacum are used in their mixtures. The mixtures requiring it must be strained.

The gentian and compound senna mixtures resemble their infusions, coriander being added to the gentian instead of lemon-peel, and a little proof spirit with maceration used instead of heat. The senna is the infusion with extract of liquorice, tinctures of cardamoms and senna, and a fifth of sulphate of magnesia added.

The aromatic and compound iron mixtures are examples of chemical decomposition: the first consists in the production of tannin, &c., and its subsequent combination with iron. All the dry ingredients, iron included, are macerated together for three days, the mixture filtered, and finally the tinctures with peppermint-water added. The second consists in the formation and preservation of carbonate of iron; the adjuncts in this mixture are myrrh, spirits of nutmeg, and rose-water, with sugar to retard oxidation; the carbonate of iron is procured by the decomposition of sulphate of iron with carbonate of potash. The solution of the sulphate of iron should be added after the mixture is otherwise made and the bottle immediately stoppered, on account of the proneness of carbonate of iron to oxidize.

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* Hydrochlorate.

MISTURA.

,, Ammoniaci. Ammoniacum, coarse powder, 1; Water, 32.

,, Amygdalæ. Compound Powder of Almonds, 1; Water, 8.

,, Creasoti. Creasote, Glacial Acetic Acid, each 1; Spt. Junip., 2; Syrup, 16; Water, 450.

,, Cretæ. Prepared Chalk, Powdered Acacia, each 1; Syrup 2; Cinnam. Water, 30.

,, Ferri Aromatica. Pale Cinchona, 1; Iron wire, Calumba, Tr. Orange, each ½; Comp. Tr. Card., 3; Cloves, ¼; Peppermint-water to 12½.

,, Ferri Composita. Sulphate of Iron, 1; Carbonate of Potash, 1⅕; Myrrh, Sugar, each 2½; Spt. Nutmeg, 10; Rose-water, 76.

,, Gentianæ. Gentian, 1; B. Orange Peel, Coriander, each ¼; Proof Spirit, 8; Water, 32; macerate in the spirit for two hours, add the water, and macerate other two hours.

,, Guaiaci. Powdered Guaiac Resin, Sugar, each 1; Acacia, ½; Cinnam. Water, 40.

,, Scammonii. Resin of Scammony, 1; Milk, 240.

,, Sennæ Composita. Sulphate of Magnesia, 1; Ext. Liquorice, ⅛; Tr. Senna, ⅝; Comp. Tr. Cardam., 2½/8; Inf. Senna, to 5.

,, Spiritûs Vini Gallici. Brandy, Cinnamon Water, each 1; Sugar, Yolk of Egg, together about 1.

MUCILAGE.

Mucilago.

„ Acaciæ. Dissolve Gum Acacia, 4, in Water, 6.

„ Amyli. Triturate Starch, 120 grains, with Water 10 oz. Boil a few minutes, constantly stirring.

„ Tragacanthæ. Agitate Tragacanth, in powder, 60 grains, with Water 10 oz.

OILS.

Two classes of oils are recognised: volatile oils and fixed oils, the former may be distilled without decomposition, whereas the latter would be decomposed at a heat sufficient to distil them. Volatile oils are dissolved in spirit or in ether, but precipitated from such solutions by water; fixed oils, except castor oil, are not very soluble in spirit, but miscible with almost any proportion of volatile oils, hence the latter, on account of their high price, are subject to a serious adulteration.

Fixed oil may be detected in volatile oil, by placing a drop of the suspected oil on a piece of white filtering paper and heating it, if any fixed oil be present a greasy stain is left.

The oils are procured by one of two processes, namely, distillation and expression.

1. Distilled Oils. The parts of plants containing the volatile oil to be distilled with water, and the oil which rises to the top, or sinks to the bottom, of the water in the receiver collected.

Oleum. Anethi, Anisi. Anthemidis, Cajuputi, Carui, Caryophylli, Cinnamomi, Copaibæ, Coriandri, Cubebæ, Juniperi, Lavandulæ, Limonis, Menthæ Piperitæ, Menthæ Viridis, Myristicæ, Pimentæ, Rosmarini, Rutæ, Sabinæ, Sinapis,* Terebinthinæ.

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* Formed during process.

2. Expressed Oils. Often it is sufficient to simply press the seeds or parts containing the (generally) fixed oil, between tinned iron plates, sometimes the parts are subjected to steam, and pressed between heated plates.

Oleum. Amygdalæ, Crotonis, Lini, Morrhuæ, Myristicæ (Expressum), Olivæ, Ricini, Theobromæ. Volatile oil may be obtained by expression, as the Oleum Limonis.

OINTMENTS.

The base of these is generally some form of lard as simple ointment, or benzoated lard. Wax is used to bring the tar to a proper consistence for an ointment, where wax is required the yellow is used, unless the ointment is white; when wax occurs a gentle heat is also necessary to dissolve it.

Ointments may be divided into two classes: (1) those which do not require heat in their preparation; the base of these may be lard, simple ointment, or benzoated lard: (2) those which, from containing wax, &c., require heat in their preparation.

I. The preparation of the greater part of the ointments of this class consists in mixing the ingredients thoroughly; the ointment of mercury must be rubbed until no globules of mercury are visible; the sulphurated potash and the iodide of sulphur must be well triturated before the lard is added, and care must be taken that the ointments are free from grittiness; the dry ingredients in the ointments of which the base is simple ointment, are to be in fine powder; where a liquid is one of the ingredients, the solid should be dissolved therein or mixed therewith, and afterwards the lard gradually added.

UNGUENTUM.				Prepared Lard.
„ Aconitiæ	Aconitia	1	Spirit 4	55
„ Atropiæ	Atropia	1	Spirit 4	55
„ Belladonnæ	Ext. Bellad.	1	Water ½	5½
„ Hydrargyri	Mercury	1	Prep. Suet $\frac{1}{16}$	1
„ Hydrargyri Subchloridi	Subchloride of Mercury	1		5½
„ Iodi	Iodine	1	Iod. Potas. 1 P. Spirit 2	27⅓
„ Potassæ Sulphuratæ	Sulphurated Potash	1		14½
„ Potassii Iodidi	Iodide of Potassium	1	Carb. Potas. $\frac{1}{16}$ Water 1	7
„ Sulphuris Iodidi	Iodide of Sulphur	1		14½
„ Veratriæ	Veratria	1	Olive Oil 4	55

			Simple Ointment.
„ Antimonii Tartarati	Tartar. Antim.	1	4
„ Cadmii Iodidi	Iodide of Cadmium	1	7
„ Creasoti	Creasote	1	8
„ Hydrargyri Ammoniati	Amm. Mercury	1	7
„ Hydrargyri Iodidi Rubri	Red Iodide Mercury	1	27⅓
„ Plumbi Carbonatis	Carbonate of Lead	1	7
„ Plumbi Iodidi	Iodide of Lead	1	7

			Benzoated Lard.
„ Gallæ	Galls, fine powder	1	5½
„ Gallæ cum Opio	Opium, powder	1	(Oint. of Galls) 13⅔
„ Plumbi Acetatis	Acetate of Lead	1	36½
„ Sulphuris	Sulphur, sub.	1	4
*„ Zinci	Oxide of Zinc	1	5½

II. For the details of the preparation of ointments of this division, the student is referred to the Pharmacopœia: the ingredients of the spermaceti, tar, turpentine, simple, elemi, and resin ointments, are melted together at a gentle heat, or at the heat of a water bath, the ointments being stirred until cold, the last two must be strained whilst hot through flannel; the cantharides are exhausted by maceration in the oil for twelve hours, the vessel being then put in boiling water for fifteen minutes, and the contents strained with strong pressure through muslin; the savin is digested twenty minutes with the other ingre-

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* A gentle heat is ordered for the zinc ointment; see P. B.

dients, and the mixture expressed through calico; if the hot solution of the nitrate of mercury, when mixed with the hot lard and oil, should not froth up, heat must be applied, the vessel in which they are mixed should be very large; the red oxide of mercury must be very finely powdered and added when the mixture of the other ingredients is nearly cold; zinc ointment, according to the Pharmacopœia, comes in this division of ointments, the lard being melted before the oxide of zinc is added; the solution of subacetate of lead is added when the wax melted in the oil shall have thickened, the camphor dissolved in a part of the oil is then added.

UNGUENTUM.
„ Cantharidis. Cantharides, Y. Wax, each 1; Olive Oil, 6.
„ Cetacei. Spermaceti, 1; W. Wax, ⅖; Almond Oil, 4.
„ Elemi. Elemi, 1; Simple Ointment, 4.
„ Hydrargyri Compositum. Oint. Mercury, 1; Y. Wax, Olive Oil, each, ½; Camphor, ¼.
„ Hydrargyri Nitratis. Mercury, 1; Nitric Acid, 3; P. Lard, 3¾; Olive Oil, 8.
„ Hydrargyri Oxidi Rubri. Red Oxide of Mercury, 1; Y. Wax, 1¾; Almond Oil, 5¼.
„ Picis Liquidæ. Tar, 1; Y. Wax, ⅖.
„ Plumbi Subacetatis Comp. Sol. Subacet. Lead, 1; W. Wax, 1⅓; Almond Oil, 3⅓; Camphor, $\frac{1}{48}$.
„ Resinæ. Resin, coarse powder, 1; Y. Wax, ½; Simple Ointment, 2.
„ Sabinæ. Fresh Savin tops, 1; Y. Wax, ⅜; Prep. Lard, 2.
„ Simplex. Prep. Lard, Almond Oil, each 1; W. Wax, ⅔.
„ Terebinthinæ. Turpentine, 1; Resin, coarse powder, ⅛; Y. Wax, Prep. Lard, each ½.

PILLS.

The process mainly consists in reducing dry ingredients to powder, adding thereto some simple liquid, or in adding some inert powders to the active ingredient occurring in a fluid condition; so that by a sort of welding or beating a mass may be obtained which should have such consistence that it will retain a rounded form, but should not be insoluble in ordinary fluids, either from composition or long keeping, nor become too hard to be rolled into pills when required; the latter condition will be in many cases avoided by enveloping the mass in skin or parchment, and preserving it in well-stopped bottles or jars.

Official excipients are: confection of roses, for the blue and aloetic pills, and for that of opium with lead; treacle, for the assafœtida, hemlock, squill, rhubarb, and ipecacuanha with squill pill; castor oil, for the compound calomel pill; and confection of hips, a useful excipient, for the quinine pill.

The mercury in the blue pill is rubbed with the confection until globules are no longer visible, when the liquorice is added. The solution of iodide of iron is made by agitating together the iron, iodine, and water, until the froth becomes white; it is then poured upon the sugar, and after brisk trituration, the liquorice is gradually added: these pills may be preserved by rolling them in porphyrized iron, and coating them with an etherial solution of mastic and tolu, but they should always be kept in well-stopped bottles.

Ordinary excipients are: hydrated magnesia, for oleoresins, as copaiba and venice turpentine; yellow wax, for essential oils and creosote; glycerine, for certain gum resins and gallic acid; crumb of bread, for calomel, perchloride of mercury, and acetate of lead; phosphate of lime, for fats, &c.; liquorice powder and lycopodium are useful as absorbents of superfluous moisture, with valerianate of zinc, extract of opium, &c.; extract of liquorice long kept, or extract of gentian, for crystalline salts, as the sulphates of iron and copper, and for some resins, such salts or resins must be very finely powdered. Phosphorus* to be made into pills may be mechanically divided by rubbing it with sugar of milk, or dissolved by heating it with oil or resin. Glycerine of tragacanth is a useful excipient.

Pills are generally rolled in some simple powder, as starch, lycopodium, magnesia, or liquorice powder; sometimes they are ordered to be gilded or silvered, in which case they must not be rolled in powder, but shaken for a few instants with gold or silver leaf in a closed jar; if pills are required to be coated with sugar, they are moistened with weak mucilage, and rolled in finely-powdered sugar, and dried in an oven at a temperature of 78°; this operation is repeated several times.

A powder (made by drying in an oven a mixture of one part of tragacanth, two parts of water, and ten parts of sugar of milk, and powdering it,) is used as a coating for pills, which should be first moistened.

PILULA.

,, Aloes Barbadensis. Barbadoes Aloes, 1; Hard Soap, ½; Confection of Roses, ½; Caraway Oil, ⅒.

,, Aloes et Assafœtidæ. Socotrine Aloes; Assafœtida; Hard Soap; Confection of Roses; equal parts.

,, Aloes et Ferri. Barbadoes Aloes, 1; Sulphate of Iron, ¾; Comp. powder of Cinnamon, 1½; Confection of Roses, 2.

,, Aloes et Myrrhæ. Socotrine Aloes, 1; Myrrh, ½; Saffron, ¼; Confection of Roses, 1¼.

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* Alkaline hypophosphites (mixtures).

Pilula—(*continued*).

„ Aloes Socotrinæ. Socotrine Aloes, 1; Hard Soap, ½; Volatile Nutmeg-oil, 1/16; Confection of Roses, ½.

„ Assafœtidæ Composita. Assafœtida, Galbanum, Myrrh, each 1. Treacle, ½.

„ Cambogiæ Composita. Gamboge; Barb. Aloes; Compound Powder of Cinnamon; each 1. Hard Soap, 2; Syrup, q. s.

„ Colocynthidis Composita. Colocynth Pulp, 1; Barbadoes Aloes, Scammony, each 2; Sulphate of Potash, Clove-oil, each ¼. Water, q. s.

„ Colocynthidis et Hyoscyami. Compound pill of Colocynth, 1; Extract of Hyoscyamus, ½.

„ Conii Composita. Extract of Hemlock, 1; Ipecacuanha, ⅕; Treacle, q. s.

„ Ferri Carbonatis. Saccharated Carbonate of Iron, 1; Confection of Roses, ¼.

„ Ferri Iodidi. Fine Iron Wire, 1; Iodine, 2; Sugar, 1¾; Liquorice-powder, 3½; Water, 1¼.

„ Hydrargyri. Mercury, 1; Confection of Roses, 1½; Liquorice-powder, ½.

„ Hydrargyri Subchloridi Composita. Subchloride of Mercury, calomel, 1; Sulphurated Antimony, Castor Oil, each 1, Guaiac Resin, 2.

„ Ipecacuanhæ cum Scillâ. Compound powder of Ipecacuanha, 1; Squill, Ammoniacum, of each, ⅓; Treacle, q. s.

„ Plumbi cum Opio. Opium, 1; Acetate of Lead, 6; Confection of Roses, 1.

„ Quiniæ. Sulphate of Quinine, 1; Confection of Hips, ⅓.

„ Rhei Composita. Rhubarb, 1; Socotrine Aloes, ¾; Myrrh, Hard Soap, each ½. Peppermint-oil, 1/16; Treacle, 1⅓.

PILULA—(*continued*).

„ Saponis Composita. Opium 1; Hard Soap, 4; Water, q. s.

„ Scillæ Composita. Squill, 1; Ammoniacum, Hard Soap, Ginger, each $\frac{4}{5}$; Treacle, q. s.

PLASTERS.

In making plasters such solid ingredients as resin and lead plaster must be liquefied before they are mixed with those substances already in a soft condition or in powder; care must be taken that the ingredients remain thoroughly mixed, that gum-resins are previously melted and strained, and where heat is required, that it is gentle: the plasters of belladonna, cantharides, and opium require the heat of a water-bath.

Two processes, at least, afford examples of chemical decomposition; those of lead and soap cerate. The first consists in simmering for a few hours a mixture of oxide of lead, olive oil, and water; oleate of lead and glycerine are formed, which together form lead plaster (some of the glycerine in excess); this also has been made by the double decomposition of a solution of soap and acetate of lead. The second consists in boiling oxide of lead and vinegar together until they have combined, to this combination first the soap, and when the moisture has evaporated, the wax and oil, melted together, are added.

The plasters, with the exception of those of ammoniacum, cantharides, and pitch, and the warm plaster, contain lead in some form. Hot olive oil and sulphur, with which the mercury is triturated until globules disappear previously to the addition of the other ingredients, form but trifling items in the mass of plaster. The alcoholic extract of belladonna is prepared by rubbing one part of ordinary extract with two parts of spirit, clearing by subsidence and evaporating spirit. The cantharides for the warm plaster must be coarsely powdered, infused six hours in boiling water, and strongly pressed in calico, the strained liquid evaporated to a third and mixed with the other ingredients.

EMPLASTRUM.

„ Ammoniaci cum Hydrargyro. Mercury, 1; Ammoniac, 4; Olive Oil, $\frac{1}{24}$; sulphur, sub. $\frac{1}{165}$.

„ Belladonnæ. The alcoholic ext. from Ext. Bell. 1; Resin Plaster 1; R. Spirit, 2.

„ Calefaciens. Powd. Cantharides, Expressed Nutmeg-oil, Y. Wax, Resin, each 1; Soap Plaster, 13; Resin Plaster, 8; B. Water, 5.

„ Cantharidis. Powd. Cantharides 1; Y. Wax, Suet, each, ⅝; Lard, ½; Resin, ¼.

„ Cerati Saponis. Hard Soap, 1; Y. Wax, 1¼; Olive Oil, 2; Oxide of Lead, 1½; Vinegar, 16.

„ Ferri. Hydrated Peroxide of Iron, 1; Burgundy Pitch, 2; Lead Plaster, 8.

„ Galbani. Galbanum, Ammoniacum, Y. Wax, each 1; Lead Plaster, 8.

„ Hydrargyri. Mercury, 1; Olive Oil, $\frac{1}{24}$; Sulphur, $\frac{1}{165}$; Lead Plaster, 2.

„ Opii. Powd. Opium, 1; Resin Plaster, 9.

„ Picis. Burgundy Pitch, 1; Resin, Y. Wax, each, about ⅙; Frankincense, ½; Expressed Nutmeg oil, $\frac{1}{26}$; Olive Oil, Water, each, $\frac{1}{13}$.

„ Plumbi. Oxide of Lead, 1; Olive Oil, 2½; Water 1, or q. s.

„ Plumbi Iodidi. Iodide of Lead, 1; Soap and Resin Plasters, each 4.

„ Resinæ. Resin, 1; Lead Plaster, 8; Hard Soap, ½.

„ Saponis. Hard Soap, 1; Resin, ⅙; Lead Plaster, 6.

POWDERS.

Ingredients to be powdered separately, mixed together, and sifted—the antimonial, tragacanth, and compound almond powders are not sifted; moreover, the compound almond powder is ordered to be only coarsely powdered, and it is to be preserved in a lightly covered jar, but stoppered bottles are used to preserve the other powders.

Heat assists the pulverization of such materials as assafœtida, jalap, gum acacia, myrrh, opium, scammony, and squill. Leaves require to be carefully dried at a low temperature.

PULVIS.

„ Amygdalæ Compositus. S. Almonds, blanched, 1; Sugar, $\frac{1}{2}$; G. Acacia, $\frac{1}{8}$.

„ Antimonialis. Oxide of Antimony, 1; Phosphate of Lime, 2.

„ Catechu Compositus. Pale Catechu, 1; Kino, Rhatany, each $\frac{1}{2}$; Cinnamon bark, Nutmeg, each $\frac{1}{4}$.

„ Cinnamomi Compositus. Cinnamon bark, 1; Cardamoms, husked, 1; Ginger, 1.

„ Cretæ Aromaticus. Prepared Chalk, 1; Nutmeg, Saffron, each $\frac{3}{11}$; Cardamoms, husked, $\frac{1}{11}$; Sugar, $2\frac{3}{11}$; Cinnamon bark, $\frac{4}{11}$; Cloves, $\frac{1\frac{1}{2}}{11}$.

„ Cretæ Aromaticus c. Opio	Opium, 1; Aromatic Powder of Chalk, 39.
„ Ipecacuanhæ Compositus	Opium, 1; Ipecacuanha, 1; Sulphate of Potash, 8.
„ Kino Compositus	Opium, 1; Kino, 15; Cinnamon bark, 4.
„ Opii Compositus	Opium, 1; Caraway, 4; Ginger, $3\frac{1}{3}$; Tragacanth, $\frac{1}{3}$; Black Pepper, $1\frac{1}{3}$.

Pulvis—(*continued*).

„ Jalapæ Compositus. Jalap, 1; Ginger, $\frac{1}{5}$; Acid Tartrate of Potash, $1\frac{4}{5}$.

„ Rhei Compositus. Rhubarb, 1; Light Magnesia, 3; Ginger, $\frac{1}{2}$.

„ Scammonii Compositus. Scammony, 1; Jalap, $\frac{3}{4}$; Ginger, $\frac{1}{4}$.

„ Tragacanthæ Compositus. Tragacanth, 1; G. Acacia, 1; Starch, 1; Sugar, 3.

RESINS.

Resina Jalapæ, Resina Scammoniæ. The roots in coarse powder are digested in spirit for twenty-four hours, and exhausted by percolation; water being added to the percolated liquor and the spirit distilled off, the resins are deposited, and should be dried by the heat of a water-bath.

Resina Podophylli. The root in coarse powder is exhausted by percolation with spirit, most of the spirit being distilled off, the residue is mixed with three times its volume of very dilute hydrochloric acid, and after twenty-four hours the resin is collected and dried in a stove. Resina. R. Guaiac. "Mat. Med."; there are no preparations of the resins of jalap and podophyllum.

SOLUTIONS.

I. Solutions of the alkaloids and arsenical salts: four grains of active ingredient contained in a fluid ounce; or one grain in a hundred and twenty minims.

(*a*) Dissolved by heat; (*b*) dissolved without heat, (^{1}) spirituous menstruum, (^{2}) aqueous menstruum.

LIQUOR.

(a)

,, Arsenicalis. Dissolve in a flask by heat Arsenious Acid, Carb. of Potash, each 4 grs., in Water, $\frac{1}{2}$ oz; to the cold solution, add Comp. Tinct. Lavand. 15 minims and Water to an ounce.

,, Arsenici Hydrochloricus. Boil until dissolved Arsenious Acid, 4 grs. in Water, $\frac{1}{2}$ oz. acidulated with Hydrochloric Acid, 6 mins., and make up with Water to an ounce.

,, Strychniæ. Dissolve by heat Strychnia crystals, 4 grs. in Water, $\frac{1}{2}$ oz. acidulated with Dil. Hydrochloric Acid, 6 mins., make up with R. Spirit and Water, equal parts, to an ounce.

(b) (1)

,, Atropiæ. Dissolve Atropia, 4 grs. in R. Spirit, 1 dm., add gradually Water, 7 dms., and mix.

,, Morphiæ Acetatis. Dissolve Acetate of Morphia, 4 grs., in a mixture of Dil. Acetic Acid, 8 mins., R. Spirit, 2 dms., Water, 6 dms.

,, Morphiæ Hydrochloratis. Dissolve Hydroch. of Morphia, 4 grs., in a mixture of Dil. Hydrochloric Acid, 8 mins., R. Spirit, 2 dms., Water, 6 dms.

(2)

,, Atropiæ Sulphatis. Dissolve Sulphate of Atropia, 4 grs. in an ounce of water.

,, Sodæ Arseniatis. Dissolve Arseniate of Soda (anhydrous by a heat not exceeding 300°), 4 grs. in an ounce of Water.

II. Gaseous solutions; solutions of salts containing carbonic acid or chlorine; (*a*) solutions of alkaline salts charged with carbonic acid gas under pressure of seven atmospheres; (*b*) chlorinated solutions.

Liquor.

(*a*)
,, Lithiæ Effervescens. A solution of Carb. Lithia, 10 grs., in a pint of water charged with carbonic acid gas.
,, Potassæ Effervescens*
,, Sodæ Effervescens
} Solutions of the Bicarbonates, 30 grs. in a pint of water, charged with carbonic acid gas.

(*b*)
,, Calcis Chloratæ. Chlorinated Lime, 1 lb.; Water, 8 pints; mix, and after three hours filter through calico, s. g. 1.035; chlorine, 3 per cent.
,, Chlori. Water charged with chlorine to s. g. 1.003.
Sodæ Chloratæ. A solution of Carb. Soda, 1 in Water, 3 charged with chlorine to the s. g. 1.103.

III. Solutions, or mixtures, not attended by chemical decomposition, nor containing alkaloids or arsenical salts, &c.

Liquor.
,, Ammoniæ. Strong solution of Ammonia, 1; Water, 2; mix.
,, Calcis. The clear solution obtained by subsidence from a mixture of Slaked Lime, 2 oz.; Water, 1 gallon.
,, Calcis Saccharatus. The clear solution from a mixture of Slaked Lime, 1; Sugar, 2; Water, 20; s. g. 1.052.
,, Epispasticus. Cantharides, powder, 8; with

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* See Liq. Mag. Carb.

LIQUOR—(*continued*).

Acetic Acid, 4; pack in a percolator, and after 24 hours percolate with ether to 20.

,, Ferri Perchloridi. Strong Solution of Perchloride of Iron, 1; Water, 3; mix.

,, Hydrargyri Perchloridi. Dissolve Perchloride of Mercury, Chloride of Ammonium, each 1 gr. in Water, 2 oz. (care.)

,, Iodi. Dissolve Iodine, 20 grs., Iodide of Potassium, 30 grs., in Water, 1 oz.

,, Plumbi Subacetatis Dilutus. Solution of Subacetate of Lead, 1; R. Spirit, 1; Water, 78; mix, filter through paper.

,, Potassæ Permanganatis. Dissolve Permanganate of Potash, 4 grs. in Water, 1 oz.

IV. Solutions attended by chemical decomposition, and which, with one or two exceptions, will be found in the first part of the synopsis.

LIQUOR.

,, Ammoniæ Acetatis. Acetic Acid, 1; Water, 5; neutralize with Carbonate of Ammonia, ⅓ or q. s.

,, Ammoniæ Citratis. Citric Acid, 1; Water, 6⅔; neutralize with strong Solution of Ammonia $\frac{11}{12}$ or q. s.

,, Ammoniæ Fortior. A solution containing 32.5 per cent. of ammoniacal gas; s. g. .891.

,, Antimonii Chloridi. Boil Black Antimony, 1, with Hydrochloric Acid, 5, fifteen minutes; filter through calico; concentrate the clear liquor to 2½, by boiling, s. g. 1.47.

,, Bismuthi et Ammoniæ Citratis. Purified Bismuth, about 1, dissolved in a mixture of Nitric Acid, 2; Water, 1; after effervescence the mixture is heated, the clear solution decanted, and concentrated to 2; a solution of Citric Acid, 2, is then

LIQUOR—(*continued*).

added, and the mixture carefully neutralized or rendered slightly alkaline with Solution of Ammonia. Water is afterwards added to 20; s. g. 1.122.

„ Ferri Perchloridi Fortior. Dissolve at a gentle heat Iron wire, 1, in a mixture of Hydrochloric Acid, 4; Water, 4; to the filtered solution add Hydrochloric Acid, 2; Nitric Acid, $\frac{9}{16}$; heat the mixture briskly, until on the sudden evolution of red fumes the liquid becomes of an orange-brown colour, when the solution is concentrated by the heat of a water-bath to 5.

„ Ferri Pernitratis. Dissolve without heat, Fine Iron Wire, 1, in a mixture of Nitric Acid, $4\frac{1}{2}$; Water, 16: more water is added if the action be violent: the filtered solution is made up to 30, with water.

„ Ferri Persulphatis. Dissolve by heat, Sulphate of Iron, 8, in a mixture of Sulphuric Acid, $\frac{3}{4}$; Water, 10; to this solution add a mixture of Nitric Acid, $\frac{3}{4}$; Water, 2. Concentrate the whole by boiling, until the liquid becomes red. (Should the solution now give a blue precipitate with red prussiate of potash, a few additional drops of nitric acid are added, and the boiling renewed.) When the solution is cold add Water to 11.

„ Hydrargyri Nitratis Acidus. Dissolve without heat Mercury, 1, in a mixture of Nitric Acid, $1\frac{1}{4}$; Water, $\frac{3}{8}$. Boil gently for fifteen minutes, cool, and preserve in a stoppered bottle.

„ Magnesiæ Carbonatis. Dissolve Sulphate of Magnesia, 1; Carbonate of Soda, $1\frac{1}{4}$ each, in Water 5. Heat the sulphate solution to boiling point,

LIQUOR—(*continued*).

and add that of the carbonate, boil until carbonic acid ceases to be evolved; collect the carbonate of magnesia on a calico filter, wash, and mix it with Water, 10, and allow the mixture to remain in contact with excess of pure carbonic acid gas under pressure for 24 hours; filter and again pass carbonic acid gas into the filtered solution, finally keep the solution in a bottle securely closed to prevent escape of carbonic acid gas.

„ Plumbi Subacetatis. Boil Acetate of Lead, 1, Oxide of Lead, $\frac{7}{10}$; in Water, 4; for half an hour, constantly stirring; filter, and when cold add Water to 4; s. g. 1.26.

„ Potassæ. Heat a solution of Carbonate Potash, 1, Water, 10, in a clean iron vessel to boiling point; add Slaked Lime $\frac{3}{4}$, and continue ebullition ten minutes, with constant stirring. Allow the liquor to cool, and to clear by subsidence: add water, if necessary, to make the clear solution correspond with tests of specific gravity and neutralizing power, and preserve it in stoppered green glass bottles; s. g. 1.058, it contains 5.84 per cent. of hydrate of potash.

„ Sodæ. Proceed as for Liquor Potassæ, substituting carbonate soda $1\frac{3}{4}$ for the potash; s. g. 1.047; 4.1 per cent. of hydrate of soda.

„ Zinci Chloridi. Heat gently until gas is no longer evolved, Granulated Zinc, 1, in a mixture of Hydrochloric Acid, $2\frac{3}{4}$; Water, $1\frac{1}{4}$; in a porcelain dish. Boil for half an hour, supplying water lost by evaporation; when cold, filter and add solution of chlorine, with agitation, until the fluid acquires a permanent odour of chlorine;

LIQUOR—(*continued*).

now add carbonate of zinc q. s. ($\frac{1}{30}$) in small quantities, and when a brown sediment appears filter the liquid into a porcelain basin, and evaporate to 2½.

SPIRITS.

These are essentially solutions of volatile oils in spirits of wine; the official spirits of wine is of two strengths, that containing most alcohol is called rectified spirit, and has the s. g. .838; the weaker spirit is called proof spirit, and has the s. g. .920.

The specific gravity of spirits and liquids may be obtained by dividing the weight of a bulk of the liquid by the weight of an equal bulk of water, the quotient being the specific gravity; the amount of alcohol present is then found by reference to tables. The areometers of Baumé and Cartier mark pure water 10; and absolute alcohol, the former 48 the latter 44.2, the difference in each degree over ten being .08.

The instrument devised by Gay-Lussac is called the centesimal alcohometer; the 0 corresponds to pure water and the 100 to absolute alcohol temperature 60° F.; each degree represents the $\frac{1}{100}$ by volume of absolute alcohol; its construction is simple, thus the extremes being marked on the scale the divisions of ten degrees are obtained from actual experiment, e. g. 90, alc. + 10 water, 80 alc. + 20, water, &c.; these divisions on the scale from mutual solution, irregular contraction of the mixture or other causes are not equidistant, each of these tenths on the scale is again divided into ten parts, which, although this time equidistant, are sufficiently accurate: corrections are always to be made for temperature: instruments fulfilling both conditions may be obtained.

The following table may be of service in estimating amount of alcohol in a mixture of alcohol and water.

Volume per cent., or centesimal alcohometer.	Weight per cent.	Sp. Gr.
0	0	1000
10	8.4	986.7
20	18.5	976.3
30	25.5	965.7
40	33.5	952.3
50	41.5	934.8
60	51	914.1
70	62	890.7
80	73	864.5
90	85	834.6
100	100	794.7

1. *Solutions of one substance in spirit. (a) Dissolve: (b) Mix or Dissolve.*

(*a*) SPIRITUS.
„ Cajuputi
„ Juniperi
„ Lavandulæ
„ Menthæ Piperitæ
„ Myristicæ*
„ Rosmarini

Oils, one, to R. Spirit, forty-nine.

(*b*) SPIRITUS.
„ Ætheris. Ether, 1; R. Spirit, 2.
„ Camphoræ. Camphor, 1; R. Spirit, 9.
„ Chloroformi. Chloroform, 1; R. Spirit, 19.
„ Rectificatus. Alcohol, 84 per cent.
„ Tenuior, proof. Water, 3; R. Spirit, 5.
„ Vini Gallici, Brandy. Alcohol, 50 per cent.

2. *Solutions of more than one substance, and obtained by distillation.*

„ Ætheris Nitrosi. Proceed by distilling spirit with nitric and sulphuric acids, and fine copper wire,

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* Volatile Oil.

SPIRITUS—(*continued*).

at 170° to 180°. A spirituous solution, containing aldehyde, nitrous ether, &c., must not be regarded as ethyl nitrite. Its acid reaction is destroyed by agitating the solution with charcoal; s. g. .845.

„ Ammoniæ Aromaticus. Strong solution of Ammonia, 1; Carbonate of Ammonia, 2; Vol. Nutmeg Oil, $\frac{1}{8}$; Lemon Oil, $\frac{1}{5}$; R. Spirit, 30; Water, 15; Distil. 35; s. g. .870.

„ Ammoniæ Fœtidus. Macerate Assafœtida, 1, small pieces, in R. Spirit, 10, for twenty-four hours; distil, and add to the distillate Strong Solution of Ammonia, $1\frac{1}{3}$; and make up with Spirit to $13\frac{1}{3}$.

„ Armoraciæ Compositus. Horseradish Root, fresh scraped, B. Orange Peel, each 1; Nutmeg, bruised, $\frac{1}{40}$; R. Spirit, Water, each 5; distil 8 with a moderate heat.

SUPPOSITORIES.

For these white wax and cacao butter are melted together at a gentle heat; the active ingredients previously mixed with the benzoated lard added; and the mixture poured before congelation into suitable moulds, of the capacity of fifteen grains. Mem.—Often too little wax ordered.

The following quantities are for twelve suppositories.

SUPPOSITORIA.

„ Acidi Tannici. Tannic Acid, 36 grs.; Benz. Lard, 44 grs.; W. Wax, 10 grs.; Theobroma Oil, 90 grs.

„ Hydrargyri. Ointment of Mercury, 60 grs.; Benz. Lard, W. Wax, each 20 grs.; Theobroma Oil, 80 grs.

SUPPOSITORIA—(*continued*).

„ Morphiæ. Hydrochlorate of Morphia, 6 grs.; Benz. Lard 64 grs.; W. Wax, 20 grs.; Theobroma Oil, 90 grs.

„ Plumbi Composita. Acetate of Lead, 36 grs.; Opium, powder, 12 grs.; Benz. Lard, 42 grs.; W. Wax, 10 grs.; Theobroma Oil, 80 gr.

Other methods:—*Extemp. without heat.*—Incorporate active ingredient with strong glycerin of tragacanth, add theobroma, roll, cut, and mould, roll in French chalk or coat with wax. *Elastic and soluble.*—Well soften gelatine in water, about two parts of this and one of glycerin may be melted together in oven, then add active ingredients suitably prepared, stir and pour into oiled mould.

SYRUPS.

(*a*) SYRUPUS. This is made by dissolving sugar in half its weight of water at a gentle heat, s. g. 1.330, which is about the ordinary specific gravity of syrups. It may be purified by adding the white of an egg beaten up with a little water, bringing up the syrup to boiling point, and removing the coagulated albumen with the impurities.

„ Aurantii.* One volume of tincture of orange to seven volumes of syrup.

„ Aurantii Floris. Made like syrup, substituting orange-flower water for a part of the water, and adding it when the syrup is nearly cold.

„ Scillæ. Vinegar of Squills, a pint; Sugar, two pounds and a half; dissolve with heat.

„ Zingiberis. Mix with agitation: Strong Tincture of Ginger, 1; Syrup, 25⅓.

(*b*) „ Limonis, Mori, Rhamni. Juices, of which the

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* Few objections to some of the other syrups being made in the same manner and of the same strength.

SYRUPUS—(*continued*).

albumen has been removed by coagulation, made into syrups, s. g. respectively, 1.34, 1.33, 1.32. The syrup of lemon is flavoured with the peel; the syrups of buckthorn and mulberry contain a small quantity of spirit. The buckthorn juice is evaporated to about half, digested four hours with ginger and pimento, when cold, spirit is added, and after two days the clear liquor decanted and the sugar dissolved therein.

„ Hemidesmi, Papaveris, Rhœados (petals), Rosæ Gallicæ (petals). Infusions in boiling water made into syrups. Hemides.; Rosæ G., s. g. 1.335; Papav. 1.320; Rhœad. 1.330. The poppy capsules are not only infused, but percolated to exhaustion, the liquor concentrated, allowed to stand with spirit; and finally, the spirit being distilled off, the liquor is further concentrated, and mixed with the sugar.

„ Ferri Iodidi, Ferri Phosphatis. Solutions of iron salts made into syrups, s. g. of the iodide, 1.385, or 6 per cent. of iodide of iron. The solution of the iodide of iron for the first syrup is made by heat, and this is filtered whilst hot into a ready-made syrup. The phosphate of iron for the syrup is made with cold solutions of the sulphate, phosphate and acetate; no heat is used in the process, but the phosphate when procured is dissolved in phosphoric acid, and to this the sugar is added. (*See* Phosphate of Iron.) (Granulated sulphate of iron is used.)

„ Rhei. Equal parts of coarsely powdered rhubarb and coriander are percolated with spirit and water, the liquor evaporated to about half, and made into a syrup.

Syrupus—(*continued*).

„ Sennæ. Senna is digested with water twenty-four hours at 120°, and the process repeated with the marc; the mixed liquors are evaporated, and when cold a spirit of coriander added, the liquid being clarified by filtration sugar is dissolved therein at a gentle heat, s. g. 1.310.

„ Tolutanus. One of balsam is boiled in sixteen of water for half an hour, the liquid made up to thirteen, filtered when cold, and made into a syrup, s. g. 1.330.

TINCTURES.

Tinctures might be divided according to the menstrua; process is here considered of primary importance, and therefore occupies the first place. Ingredients admitting it, as roots, should be coarsely powdered, bruised, or cut small; lemon peel, in its tincture, is directed to be fresh; the leaves of belladonna, digitalis, and hyoscyamus, are ordered to be dried and coarsely powdered. Colchicum seed is now bruised; formerly on account of veratria this was avoided. Cardamoms should be freed from pericarps, gentian and calumba, although roots, are not powdered.

The tinctures are grouped first according to process, afterwards according to strength.

Notes.—T. Aloes—three parts extract of liquorice to one of aloes. T. Benz. Co.—aloes, tolu, storax, macerated with the benzoin. T. Card. Co.—cardamoms, caraway, raisins freed from their seed, cinnamon, cochineal, macerated together. T. Catechu—one of cinnamon to two and a half of pale catechu. T. Chlorf. Co.—spirit of chloroform, double strength, coloured with tincture of cardamoms. T. Cinch. Co.—pale cinchona, orange-peel, serpentary, saffron, cochineal, macerated together.

T. Gent. Co.—gentian, orange-peel, cardamoms, macerated together. T. Lavand. Co.—oils of lavender and rosemary added after the maceration of the red sandal wood, cinnamon and nutmeg. T. Opii Amm.—opium, aniseed oil, benzoic acid, saffron, macerated with strong solution of ammonia and spirit. T. Nucis Vom.—seeds may be powdered by first steaming then rapidly drying them. T. Rhei—rhubarb, cardamoms, coriander, saffron, macerated together. T. Sennæ—senna, raisins freed from their seeds, caraway, coriander, macerated together. T. Tolutana—balsam macerated six hours, or until solution be effected.

PROCESSES.

Process I.—Macerate the ingredients in three-fourths of the spirit forty-eight hours in a closed vessel, agitating occasionally; transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining fourth of the spirit. Afterwards subject the contents of the percolator to pressure; filter the product, mix the liquids, and make up loss with more spirit.

Tinctures made according to the above process:—

(*a*) *with rectified spirit or spirit, s. g.* 0.838.

Tr. Aconiti (root). Arnicæ, Capsici, Cubebæ, Myrrhæ, Nucis Vomicæ, Pyrethri, Veratri Viridis, Zingiberis.

(*b*) *with proof spirit, or spirit s. g.* 0.920.

Tr. Belladonnæ (leaves in powder) Buchu, Calumbæ, Cardamomi Composita, Cascarillæ, Chiratæ, Cinchonæ Composita, Cinchonæ Flavæ, Cinnamomi, Colchici Seminum, Conii (fruit), Croci, Digitalis, Ergotæ, Gallæ, Gentianæ Composita, Hyoscyami, Jalapæ, Krameriæ, Lobeliæ, Lupuli, Rhei, Sabinæ (dried tops in powder), Scillæ, Senegæ, Sennæ, Serpentariæ, Stramonii (seeds), Sumbul, Valerianæ.

PROCESS II.—Macerate the ingredients in the spirit for seven days in a closed vessel, with occasional agitation; strain, press, filter, make up loss with spirit. (*See* Wines.)

Tinctures made according to the above process:—

(*a*) *with rectified spirit.*

Tr. Assafœtidæ, Benzoini Composita, Castorei, Kino, Lavandulæ Composita, Opii Ammoniata, Tolutana.

(*b*) *with proof spirit.*

Tr. Aloes, socotrine, Aurantii, Camphoræ Composita,* Cantharidis, Catechu, Cocci, Limonis (fresh peel), Opii, Quassiæ.

(*c*) *with other forms of spirit.*

1. *aromatic spirit of ammonia.*

Tr. Guaiaci Ammoniata (resin), Valerianæ Ammoniata.

2. *with spirit of ether.*

Tr. Lobeliæ Ætherea.

PROCESS III.—Dissolve or mix the ingredients with the spirit.

(*a*) *with rectified spirit.*

Tr. Cannabis Indicæ (Ext.), Chloroformi Composita, Ferri Acetatis (*see* Acetates), Ferri Perchloridi, Iodi.

(*b*) *with tincture of orange.*

Tr. Quiniæ. Dissolve with the aid of a gentle heat, after three days filter.

PROCESS IV.—Exhaust ten ounces of the ingredient (it should be moistened with half of the spirit and allowed to remain in the percolator two hours) by percolation and make up the volume to a pint.

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* Opium, Benz. Acid } 40 grs. Camph. 30 grs., Anis. Ol. 30 ms. } Spt. a pint.

(*a*) *with rectified spirit.*

Tr. Zingiberis Fortior.

STRENGTH.

A. *Two ounces and a half of active ingredient in a pint,* 54$\frac{11}{16}$ *grains in a fluid ounce, or about* 1 *in* 8.

Tr. Aconiti, Assafœtidæ, Buchu, Calumbæ, Cascarillæ, Catechu, Chiratæ, Cinnamomi, Cocci, Colchici Seminum, Conii, Cubebæ, Digitalis, Gallæ, Hyoscyami, Jalapæ, Krameriæ, Limonis, Lobeliæ, Lobeliæ Ætherea, Lupuli, Myrrhæ, Sabinæ, Scillæ, Senegæ, Sennæ, Serpentariæ, Stramonii, Sumbul, Tolutana, Valerianæ, Valerianæ Ammoniata, Zingiberis.

B. *Two ounces of active ingredient in a pint,* 43$\frac{3}{4}$ *grs. in a fluid ounce, or about* 1 *in* 10.

Tr. Aurantii, Benzoini Composita, Chloroformi Co., Cinchonæ Composita, Kino, Nucis Vomicæ, Rhei.

C. *One ounce of active ingredient in a pint,* 21$\frac{7}{8}$ *grs. in a fluid ounce, or about* 1 *in* 20.

Tr. Arnicæ, Belladonnæ, Cannabis Indicæ, Castorei, Croci.

D. VARIOUS.

TINCTURA.		Act. Ing. in Pint.	One of Act. Ing. in.
„	Aloes	$\frac{1}{2}$ oz.	40
„	Camphoræ Co.	Opium, 40 grs.	240
„	Cantharidis	$\frac{1}{4}$ oz.	80
„	Capsici	$\frac{3}{4}$ oz.	27
„	Cardamomi Co.	$\frac{1}{4}$ oz.	80
„	Cinchon. Flav.	4 oz.	5
„	*Ergotæ*	5 oz.	4

TINCTURA—(*continued*).

		Act. Ing. in Pint.	One of Act. Ing. in.
,,	Ferri Acetatis (Fer. Perch. + Amm. Ac. unstable).		
,,	Ferri Perchlor. (S. Sol. Per. Iron, 1 vol., R. Spt. 3 vols.)		
,,	Gentianæ Comp.	$1\frac{1}{2}$ oz.	13
,,	Guaiac Am.	4 oz.	5
,,	Iodi	$\frac{1}{2}$ oz. Pot. Iod. $\frac{1}{4}$ oz. . .	40
,,	Lavand. Co.	45 min. Lav. oil	213
,,	Opii	$1\frac{1}{2}$ oz.	13
,,	Opii Amm.	$\frac{8}{35}$ oz.	96
,,	Pyrethri	4 oz.	5
,,	Quassiæ	$\frac{3}{4}$ oz.	27
,,	Quiniæ	. . . .	60
,,	Veratri Virid.	4 oz.	5
,,	Zingib. Fortior	10 oz.	2

WATERS.

The official water is the purest that can be obtained, cleared if necessary by filtration; it is used for the distillations, where water is mentioned in other parts of this synopsis, whether as a solvent of salts or otherwise, distilled water is intended; this is procured by distilling from ten volumes of water eight volumes and a half, rejecting the first half volume.

The waters, with the exception of the cherry laurel, may be looked upon when fresh as weak solutions of volatile oils in water, but when long kept they appear to be definite combinations of the oils and water: camphor-water is a solution of indefinite strength, containing about half a grain of camphor in each ounce; where flowers are used they may be either fresh or salted, the quantity of water ordered for these is far too small, moreover, salted petals are objectionable, powdered charcoal is likely to be more successful.

Cherry-laurel water is a solution of hydrocyanic acid, and is of variable strength; the variation being due to development of leaf, season, maceration, &c. A solution of camphor in tincture of myrrh is miscible with water.

1. Add two gallons of water to the ingredients, and distil a gallon.

Aqua—Anethi, Carui, Fœniculi, of the bruised fruit a pound.

„ —Aurantii Floris, Rosæ,* Sambuci, of the fresh petals ten pounds.

„ —Cinnamomi, Pimentæ. Cinnamon, 20 oz., Pimento, 14 oz.; bruised.

2. Add to a drachm and a half of the oil a gallon and a half of water; distil one gallon.

„ Menthæ Piperitæ, Menthæ Viridis.

3. Add two pints and a half of water to a pound of the fresh chopped leaves, macerate 24 hours; distil a pint, shake and filter product.

„ Laurocerasi

4. Immerse half an ounce of camphor, broken and enclosed in a muslin bag, in a gallon of water, for at least two days.

„ Camphoræ.

WINES.

These resemble tinctures, sherry, with the exception of the quinine and citrate of iron wines, being the menstruum instead of spirit.

Process I.—Macerate ingredients seven days with the sherry wine, in a closed vessel, and with occasional agitation; filter and make up loss.

Vinum. Aloes, soc.; Colchici, sliced and dried corm;

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* R. Centifolia.

VINUM—(*continued*).

Ipecacuanhæ, bruised; Opii, ext.; Rhei, coarsely powdered; V. Ferri, fine iron wire, made in similar manner, but requires to stand thirty days.

PROCESS II.—Dissolve; filter solution if necessary.

Vinum. Antimoniale, tartarated antimony, and sherry.

,, Ferri[*] Citratis. V. Quiniæ. These are solutions in orange wine, which require to stand three days before filtration; in that of quinine the citric acid is first dissolved in the orange wine, and then the sulphate of quinine.

,, Aurantii. Wine made in Britain from the fresh peel of the bitter orange; it contains 12 per cent. of alcohol.

,, Xericum, sherry, a Spanish wine; it contains 18 per cent. of alcohol.

STRENGTH—*see* Tinctures.

		About 1 of Act. Ing. in
,,	Aloes. Ginger and Cardamoms, $\frac{1}{3}$	26
,,	Antimoniale, tart. antim., 2 grs. in an ounce	240
,,	Aurantii alcohol	8
,,	Colchici, not filtered, but strained through calico	5
,,	Ferri	20
,,	Ferri Citratis (Fer. et Am. Cit.)	60
,,	Ipecacuanhæ, 22 grains in an ounce	20
,,	Opii, extract; Cinnamon and Cloves, $\frac{1}{6}$	20
,,	Quiniæ, a grain of quinine and a grain and a half of citric acid in a fl. ounce.	
,,	Rhei, Canella Alba Bark, $\frac{1}{11}$	13
,,	Xericum alcohol	6

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[*] Rest and filtration unnecessary.

VINEGARS.

Acetum.

„ Cantharidis. Cantharides in powder, 1, Glacial Acetic Acid, 1, are digested two hours with six parts of acetic acid at a temperature of 200°; finally the cantharides are exhausted by percolation with more acetic acid, and pressed; ten fluid ounces of the vinegar contain the strength of an ounce of cantharides.

„ Scillæ. Macerate bruised Squill, 1; in Diluted Acetic Acid, 8, for seven days; strain with expression, and add Proof Spirit, $\frac{3}{5}$.

Oxymel. Liquefy Honey, clar., 8, by heat, and mix with Acetic Acid and Water, each 1.

Oxymel Scillæ. Mix Vinegar of Squills, a pint, with Honey, clar., two pounds; evaporate by a water-bath to s. g. 1.32, when cold.

VARIOUS.

Adeps Præparatus. The internal fat of the hog, purified by careful washing with cold water, liquefying and straining through flannel; lastly, by driving off the water at a heat of 212°, and again straining. This is the "lard" intended where lard is ordered in the Synopsis.

Adeps Benzoatus. Made by adding to a pound of melted prepared lard 160 grains of powdered Benzoin, heating the mixture for two hours, and straining.

Charta Epispastica. Cantharides, White Wax, Olive Oil, Spermaceti, Resin, and Water, are digested in a water-bath for two hours; the watery liquid being separated, Canada Balsam is added, and strips of paper *passed* over the hot liquid, so that one surface of the paper may receive a thin coating of the plaster. About one of Cantharides in ten of mass.

Collodium. Add Pyroxylin, 1, to a mixture of Ether, 36; R. Spirit, 12; set aside for a few days, decant the clear solution. Keep in a well-corked bottle.

Collodium Flexile. Mix Collodium, 6 f. oz.; Canada Balsam, 120 grs.; Castor Oil, 1 f. drachm. Keep in a well-corked bottle.

Fel Bovinum Purificatum. Ox bile is purified by agitating it with two volumes of r. spirit, allowing twelve hours for the sediment to subside, and then evaporating the clear liquor by the heat of a water-bath to a pilular consistence.

Mel Boracis. About one part of Borax, mixed with seven parts of clarified Honey.

Mel Depuratum. Honey, melted in a water-bath, and strained hot through moistened flannel. This is the "honey" intended where honey is ordered in the Synopsis.

TABLE OF DOSES.

*I. Dose rarely exceeding one grain or one minim: the fractions as they stand denote the maximum dose, but each denominator, with unity for a numerator, will give the minimum dose. Antim. Tart. 1 to 2 grs., and Cupri Sulph. 5 to 10 grs., are emetic.

Acid. Arsen.	$\frac{5}{60}$	Ext. Stram.	$\frac{2}{4}$
Antim. Tart. . . .	$\frac{32}{16}$	Ferr. Arsen.	$\frac{8}{16}$
Arg. Nit.	$\frac{2}{6}$	Hyd. Iod. R. . . .	$\frac{4}{16}$
Arg. Ox.	$\frac{2}{2}$	Hyd. Ox. R. . . .	$\frac{4}{4}$
Capsici Fruc. . . .	$\frac{2}{2}$	Hyd. Perchl. . . .	$\frac{2}{16}$
Cupri Sulp.	$\frac{8}{4}$	Hyd. Subchl. . . .	$\frac{10}{2}$
Digitalin	$\frac{2}{60}$	Iodum	$\frac{1}{2}$
Elater.	$\frac{8}{16}$	Liquores Atrop. . .	1
Ext. Bell.	$\frac{4}{4}$	Morph. Ac. et Hc. . .	$\frac{4}{8}$
Ext. Cann. I. . . .	$\frac{4}{4}$	Ol. Croton	$\frac{3}{3}$
Ext. Acon. Ex. Colch. Ext. Nuc. V. Ext. Opii } . . .	$\frac{4}{2}$	Opium.	$\frac{4}{2}$
		Podoph. Res. . . .	$\frac{4}{4}$
		Sodæ Arsen.	$\frac{2}{16}$
		Strychnia.	$\frac{3}{36}$
Ext. Physost. . . .	$\frac{4}{16}$	Zinci Chlor. . . .	$\frac{1}{2}$

*II. Minimum dose less than five grains or minims; maximum dose not exceeding ten.

Acid. Carbol. . . .	3	Cambogia	4
Acid. Hydrocy. D. .	8	Camphor	10
Acid. Gall.	10	Cerii Oxal.	2
Acid Tann.	10	Creosote	3
Aloes Barb.	6	Colocy. Pulp. . . .	8
Aloes Soc.	6	Ext. Aloes B. . . .	6
Amm. Carb.	10	Ext. Aloes S. . . .	6
Antim. Sulph. . . .	5	Ext. Conii	6
Antim. Oxid. . . .	4	Ext. Papav.	5

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* P.B., but with some additions.

Ferr. Redac.	5
Ferri Sulph.	5
Ferri. Sulph. Exsic.	3
Hydr. Cret.	8
Hyd. Iod. Vir.	3
Jalapæ Resin	5
Liq. Arsen.	8
Liq. Arsen. H.	8
Liq. Strych.	10
Olea "essentia," gen.	4
Ol. Cajuput.	5
Ol. Junip.	3
Ol. Sabin.	5
Pil. Ferri Iod.	8
Pil. Hydrarg.	8
Pil. Plb. cum Opio	5
Pil. Quiniæ	10
Pil. Sapon. Co.	5
Plumb. Acet.	8
Potassii Iod.	10
Potass. Perm.	2
Pulv. Antim.	10
Pulv. Cinn. Co.	10
Pulv. Opii Co.	5
Quin. Sulph.	10
Sabadilla	6
Scamm. Res.	8
Scilla	3
Sodæ Val.	5
Zinci Ox.	10
Zinci Val.	3

III. Minimum dose five grains or five minims; maximum dose not exceeding thirty; (*a*) 5-10; (*b*) 5-15; (*c*) 5-20; (*d*) 5-30.

5—10

Assafœtida
Beber. Sulph.
Castor.
Ext. Lupul.
Fel. Bovin. P.
Ferr. et Amm. Cit.
Ferr. et Quin. Cit.
Ferr. Ox. Mag.
Ferri Phosp.
Ferr. Tart.
Lithiæ Cit. (or more)
Moschus
Pilulæ, gen.
Scammonium
Tr. Aconit.

5—15

Acid. Benz.
Bism. Subn.
Ext. Jalapæ
Ext. Tarax.
Myristica
Sapo Dur.

5—20

Acid Nitrohyd. Dil.
Acid Sulph. Dil.
Amm. Brom.
Amm. Phos.
Bismuth. Carb.
Cardamomum
Conf. Opii.
Ferri Carb. Sacc.

Tinct. Conii
„ Croci
„ Ergot.
„ Gallæ
„ Guaiac. Am.
„ Hyos.
„ Jalapæ
„ Kino
„ Lavand. Co.
Tinct. Limonis
„ Myrrhæ
„ Opii Am.
„ Sabinæ (30)
„ Scillæ
„ Senegæ
„ Serpentar.
„ Sumbul
„ Valer.

VI. Minimum dose a drachm; maximum dose one, two, three, or four drachms.

Acid. Acet. D. . . .	3
Conf. Sennæ	2
Conf. Sulph	2
Conf. Tereb.	4
Cubebæ	2
Ext. Belæ Liq. . . .	2
Ext. Sarsæ Liq. . . .	4
Filix Mas	2
Kamala	2
Muc. Acaciæ	4
Ol. Morrhuæ	4
Ol. Tereb. (10 min.). .	4
Pulv. Amyg. Co. . .	2
Lact. Sacch.	2
Sod. Cit. tart. Eff. . .	2
Spt. Armorac.. . . .	3
Succ. Scoparii	2
Syr. Aurant.	2
Syr. Aurant. Fl. . . .	2
Syr. Ferri Phos. . . .	2
Syr. Hemidesm. . . .	4
Syr. Limon.	2
Syr. Mori.	2
Syr. Papav.	1
Syr. Rhamni	1
Syr. Rhei	4
Syr. Rhœados. . . .	2
Syr. Rosæ Gall. . . .	1
Syr. Sennæ	2
Syr. Tolu.	2
Syr. Zingib.	4
Tr. Aloes	2
Tr. Arnicæ.	2
Tr. Aurant.	2
Tr. Buchu	2
Tr. Cinch. Fl. . . .	2
Tr. Cinnam.	2
Tr. Cubebæ	2
Tr. Gent. Co. . . .	2
Tr. Kramer.	2
Tr. Quassiæ	2
Tr. Quiniæ . . .	(1½)
Tr. Rhei	2
Tr. Valer.	2
Vin. Aloes	2
Vin. Ferri	4
Vin. Ferr. Cit. . . .	4
Vin. Rhei	2

VII. Dose between a drachm and ounce.

Cusso	2—4	Ol. Tereb.	—
Manna	2—8	Sod. Tart.	2—4
Mag. Sul.	1—4	Succ. Tarax.	2—4
Mang. Sul.	1—4	Tr. Sennæ	2—4
Ol. Amyg. (dulc.)	2—4	Vin. Ipecac. (emet.)	3—6
Ol. Olivæ	4—8	Vin. Quiniæ	4—8
Ol. Ricini	1—8		

The above tables include most of the official substances and preparations, the latter will be tabulated again with notes.

Aquæ.—Thirty minims is the maximum dose of cherry-laurel water; one ounce, of dill and orange-flower waters; two ounces of the others.

Confectiones.—20 grains maximum dose of the confections indiscriminately; or two drachms, with the exception of scammony and opium.

Decocta.—2 ounces maximum dose of the decoctions indiscriminately, but some are only for external use.

Essentia.—10 to 20 minims.

Extracta.—¼ grain maximum dose of the extracts indiscriminately, or five grains, with the exception of those of aconite, belladonna, nux vomica, Calabar bean, stramony, opium, Indian hemp, and colchicum (see division I). Ext. Mezereon is not given internally.

Infusa.—½ ounce maximum dose of the infusions indiscriminately; or two ounces, with the exception of digitalis.

Liquores.—8 minims maximum dose of solutions, for internal use, indiscriminately; or twenty minims, with the exception of those of strychnine and arsenical salts. The strong solutions of ammonia and perchloride of iron, those of nitrate of mercury and persulphate of iron, those of antimony, atropine, iodine, lead, and zinc, with the epispastic, are not for internal use.

Misturæ.—1 ounce maximum dose of the mixtures indiscriminately.

Olea.—1 minim maximum dose of the oils indiscriminately; or three minims, with the exception of those of croton, mustard, and the concrete nutmeg-oil.

Pilulæ.—5 grains maximum dose of the pills indiscriminately; or ten grains, with the exception of those of lead, soap, *i.e.* opium, iodide of iron, and blue pill.

Pulveres.—5 grains maximum dose of the powders indiscriminately; or ten grains, with the exception of the compound powders of ipecacuanha, kino and opium.

Spiritus.—30 minims maximum dose of the spirits indiscriminately; or sixty minims, with the exception of camphor and rosemary.

Succi.—60 minims maximum dose of the juices indiscriminately.

Syrupi.—60 minims maximum dose of the syrups indiscriminately.

Tincturæ.—10 minims maximum dose of the tinctures indiscriminately, or twenty minims, with the exception of the tincture of aconite. T. Pyreth., no dose given.

Trochisci.—3 maximum number for a dose of the lozenges indiscriminately.

Vina.—30 minims maximum dose of the wines indiscriminately, or two drachms, with the exception of antimony, colchicum, and opium.

RATIONAL OR CALCULATED DOSES.

(Effects of preparations more speedy.)

Aconiti Folia, dried, 2—7. grs.
Radix, dried, ½—4. grs. Tinct. 4—30 min.

Caution. Aconitia rarely given internally.
Dose $\frac{1}{50}$th gr. ($\frac{1}{12}$ gr. Dr. Hager) ($\frac{1}{10}$th gr. fatal?)

Belladonnæ Folia, dried, 1—5 grs. Tinct. 20—100 min.
Radix, dried, 3 grs. (Dr. Hager).
Caution, Atropia, dose rarely exceeding $\frac{1}{20}$th gr. Effects destroyed by caustic alkalies (strong?) not by the bicarbonates.

Colchici Cormus, dried, 2—8 grs. Vin. 10—40 min.
Semina 2—5 grs. Tinct. 16—40 min.

Conii Folia, dried, 1—15 grs.
Fructus, 3—7 grs (by deduction from tincture).
The fruit contains about 1 per cent. of conia.

Digitalis Folia, dried, $\frac{1}{2}$—$1\frac{1}{2}$ gr. P.B. Tinct. 10—30 min. P.B. The rational dose of tincture is, according to the powder, about 12 minims, but the Pharm. sanctions the equiv. of nearly 4 grs. Other works sanction 15 grs. of the powder equal to two drachms of tincture P.B., this heroic dose (more?) has been prescribed without any special note of same. (Prescription refused.)

Nux Vomica, powder, 5 grs. max. (15 grs. Royle) rational or calculated dose of the tincture, perhaps unsafe. Tinct. 10—20 min. P.B.

The student is advised to extend this list.

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